



# VIVEKANANDHA

## COLLEGE OF ENGINEERING FOR WOMEN

(An Autonomous Institution Affiliated to Anna University-Chennai  
Approved by AICTE – Accredited by NAAC and ISO 9001:2008 Certified)

Elayampalayam , Tiruchengode – 637 205,  
Namakkal District, Tamilnadu.



### DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

## B.E- ELECTRICAL AND ELECTRONICS ENGINEERING (CURRICULUM & SYLLABUS -2019)



Applicable to the students admitted from the academic year 2021- 2022 onwards

**(Regulation 2019)**

## **COLLEGE VISION**

To impart value based education in Engineering and Technology to empower young women to meet the societal exigency with a global outlook.

## **COLLEGE MISSION**

- To provide holistic education through innovative teaching-learning Practices
- To instill self confidence among rural students by supplementing with Co-curricular and extra-curricular activities
- To inculcate the spirit of innovation through training, research and Development
- To provide industrial exposure to meet the global challenges
- To create an environment for continual progress through lifelong learning

## **DEPARTMENT VISION**

The Vision of Electrical and Electronics Engineering Department is to be a center of excellence in technical education and research by producing world-class graduates to meet future challenges of the country.

## **DEPARTMENT MISSION**

The Mission of the Electrical and Electronics Engineering Department is

- To impart quality education to our students and provide a comprehensive understanding of Electrical & Electronics Engineering and produce a new generation of knowledgeable, skilled, innovative engineers.
- To stabilize the students to understand the responsibility as an engineer who prove to be good citizens having concern for society, environment and ethical issues.
- To evolve the student community to adapt appropriate sustainable technologies through remarkable contribution for rural needs.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEO's)**

**PEO1:** To provide students with the knowledge of Basic Sciences in general and Electrical and electronics Engineering in particular so as to acquire the necessary skills for analysis and synthesis of problems in generation, transmission and distribution.

**PEO2:** To provide technical knowledge and skills to identify, comprehend and solve complex tasks in industry and research and inspire the students to become future researchers / scientists with innovative ideas.

**PEO3:** To prepare the students for successful employment in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to handle critical situations and meet deadlines.

**PEO4:** To train the students in basic human and technical communication skills so that they may be good team-members, leaders and responsible citizen

## **PROGRAM SPECIFIC OUTCOMES (PSO's):**

**PSO 1. Basic Knowledge:** Apply fundamental knowledge to identify, formulate, design and investigate various problems of electrical, electronic circuits and power systems.

**PSO 2. Software Tools:** Apply modern software tools for design, simulation and analysis of electrical systems to engage in life- long learning and to successfully adapt in multi-disciplinary environments.

**PSO 3. Electrical Engineering Problem Solved:** Solve ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively.

**PSO 4. Understand Recent Technology:** Ability to understand the recent technological developments in Electrical & Electronics Engineering and develop products/software to cater the societal & Industrial needs.

## **PROGRAM OUTCOMES (PO's)**

**PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.



**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

|                      | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |                |                |            |  |           |               |            |            |
|---|---|----------------|----------------|------------|---|-----------|---------------|------------|------------|
| Programme   | <b>B.E. / B.Tech.</b>   | Programme Code | 102            | Regulation | <b>2019</b>   |           |               |            |            |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                | Semester       |            | <b>I</b>  |           |               |            |            |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019 - 2020 onwards) |   |                |                |            |   |           |               |            |            |
| Course Code   | Course Name   | Category       | Periods / Week |            |   | Credit    | Maximum Marks |            |            |
|   |   |                | L              | T          | P   |           | C             | CA         | ESE        |
| <b>THEORY</b>   |   |                |                |            |   |           |               |            |            |
| U19MA101  | Calculus*   | BSC            | 3              | 1          | 0   | 4         | 40            | 60         | 100        |
| U19EN101  | English For Communication- I *  | HSC            | 3              | 0          | 0   | 3         | 40            | 60         | 100        |
| U19CH105  | Engineering Chemistry <sup>@</sup>  | BSC            | 3              | 0          | 0   | 3         | 40            | 60         | 100        |
| U19CS101  | Programming for Problem Solving*  | ESC            | 3              | 0          | 0   | 3         | 40            | 60         | 100        |
| U19GE101  | Engineering Graphics*   | ESC            | 2              | 0          | 3   | 3         | 40            | 60         | 100        |
| <b>PRACTICAL</b>  |   |                |                |            |   |           |               |            |            |
| U19CH106  | Chemistry Laboratory <sup>@</sup>   | BSC            | 0              | 0          | 4   | 2         | 60            | 40         | 100        |
| U19CS102  | Computer Practices Laboratory*  | ESC            | 0              | 0          | 4   | 2         | 60            | 40         | 100        |
| <b>MANDATORY COURSES</b>  |   |                |                |            |   |           |               |            |            |
|   | Mandatory course - II   | MC             | 3              | 0          | 0   | 0         | 100           | -          | 100        |
| <b>Total</b>  |   |                |                |            |   | <b>20</b> | <b>420</b>    | <b>380</b> | <b>800</b> |



BSC - Basic Science Courses, ESC- Engineering Science Courses, PCC- Professional core courses, PEC- Professional Elective courses, OEC- Open Elective courses, MC- Mandatory courses,

HS- Humanities and Social Sciences, EEC- Employability Enhancement Courses, SI- Summer Industry Internship, PROJ-IT- Project, CA- Continuous Assessment, ESE - End Semester Examination.

\*Common for all branches

@ Common for ECE,EEE,BME

Signature of the BOS chairman, EEE

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|--|---|----------------|----------------|------------|-------------|---|---------------|------------|-------------|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     | Regulation | <b>2019</b> |   |               |            |             |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                | Semester       | <b>II</b>  |             |   |               |            |             |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |   |                |                |            |             |   |               |            |             |
| Course Code  | Course Name   | Category       | Periods / Week |            |             | Credit  | Maximum Marks |            |             |
|  |   |                | L              | T          | P           |   | C             | CA         | ESE         |
| <b>THEORY</b>  |   |                |                |            |             |   |               |            |             |
| U19MA202   | Linear Algebra and Ordinary Differential Equations *  | BSC            | 3              | 1          | 0           | 4   | 40            | 60         | 100         |
| U19EN202   | English For Communication-II *  | HSC            | 3              | 0          | 0           | 3   | 40            | 60         | 100         |
| U19PH207   | Engineering Physics \$  | BSC            | 3              | 0          | 0           | 3   | 40            | 60         | 100         |
| U19CS203   | Python Programming  | ESC            | 3              | 0          | 0           | 3   | 40            | 60         | 100         |
| U19GE202   | Basic Civil and Mechanical Engineering*   | ESC            | 3              | 0          | 0           | 3   | 40            | 60         | 100         |
| U19EE202   | Electric Circuit Theory   | P<br>C         | 3              | 0          | 0           | 3   | 40            | 60         | 100         |
| U19TA201   | Heritage of Tamils# / தமிழர்மரபு#   | HSC            | 2              | 0          | 0           | 1   | 40            | 60         | 100         |
| <b>PRACTICAL</b>   |   |                |                |            |             |   |               |            |             |
| U19PH208   | Physics Laboratory\$  | BSC            | 0              | 0          | 4           | 2   | 60            | 40         | 100         |
| U19GE203   | Engineering Practices Laboratory*   | ESC            | 0              | 0          | 4           | 2   | 60            | 40         | 100         |
| <b>MANDATORY COURSES</b>   |   |                |                |            |             |   |               |            |             |
|  | Mandatory course - I  | MC             | 3              | 0          | 0           | 0   | 100           | -          | 100         |
| <b>Total</b>   |   |                |                |            |             | <b>23</b>   | <b>460</b>    | <b>440</b> | <b>900</b>  |
| <b>Total Credits#</b>  |   |                |                |            |             | <b>24</b>   | <b>500</b>    | <b>500</b> | <b>1000</b> |



CA- Continuous Assessment, ESE - End Semester Examination.

\* Common for all branches

\$ Common for ECE,EEE,BME

# Applicable to the students admitted from the academic year 2022-2023

Signature of the BOS chairman, EEE

|                     | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |                |                |            |  |           |               |            |             |
|--|---|----------------|----------------|------------|---|-----------|---------------|------------|-------------|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     | Regulation | <b>2019</b>   |           |               |            |             |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                | Semester   | <b>III</b>  |           |               |            |             |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |   |                |                |            |   |           |               |            |             |
| Course Code  | Course Name   | Category       | Periods / Week |            |   | Credit    | Maximum Marks |            |             |
|  |   |                | L              | T          | P   |           | C             | CA         | ESE         |
| <b>THEORY</b>  |   |                |                |            |   |           |               |            |             |
| U19MA303   | Transforms and Partial Differential Equations*  | BSC            | 3              | 1          | 0   | 4         | 40            | 60         | 100         |
| U19EE303   | Analog Electronics  | PCC            | 3              | 0          | 0   | 3         | 40            | 60         | 100         |
| U19EE304   | Digital Logic Circuits  | PCC            | 3              | 0          | 0   | 3         | 40            | 60         | 100         |
| U19EE305   | Electromagnetic Fields  | PCC            | 3              | 0          | 0   | 3         | 40            | 60         | 100         |
| U19EE306   | Measurements and Instrumentation  | PCC            | 3              | 0          | 0   | 3         | 40            | 60         | 100         |
| U19EE307   | DC Machines and Transformers  | PCC            | 3              | 0          | 0   | 3         | 40            | 60         | 100         |
| U19TA302   | Tamils & Technology# / தமிழரும் தொழில்நுட்பமும்#  | HSC            | 2              | 0          | 0   | 1         | 40            | 60         | 100         |
| <b>PRACTICAL</b>   |   |                |                |            |   |           |               |            |             |
| U19EE308   | Analog and Digital Electronics Laboratory   | PCC            | 0              | 0          | 4   | 2         | 60            | 40         | 100         |
| U19EE309   | DC Machines and Transformers Laboratory   | PCC            | 0              | 0          | 4   | 2         | 60            | 40         | 100         |
| <b>MANDATORY COURSES</b>   |   |                |                |            |   |           |               |            |             |
|  | Mandatory Course - III  | MC             | 3              | 0          | 0   | 0         | 100           | --         | 100         |
| <b>Total Credit</b>  |   |                |                |            |   | <b>23</b> | <b>460</b>    | <b>440</b> | <b>900</b>  |
| <b>Total Credits<sup>#</sup></b>   |   |                |                |            |   | <b>24</b> | <b>500</b>    | <b>500</b> | <b>1000</b> |

CA - Continuous Assessment, ESE - End Semester Examination, BSC - Basic Science Courses, PCC – Professional Core Courses, MC-Mandatory courses

\* Common Syllabus for CSE, EEE, ECE, IT& BT

# Applicable to the students admitted from the academic year 2022-2023

Signature of the BOS chairman, EEE





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Chennai) Elayampalayam, Tiruchengode – 637 205



| Programme  | <b>B.E</b>   | Programme Code | <b>102</b>     |   |          | Regulation | <b>2019</b>   |            |            |
|--|--|----------------|----------------|---|----------|------------|---------------|------------|------------|
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>      |                |                |   | Semester | <b>IV</b>  |               |            |            |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |  |                |                |   |          |            |               |            |            |
| Course Code  | Course Name  | Category       | Periods / Week |   |          | Credit     | Maximum Marks |            |            |
|  |  |                | L              | T | P        |            | C             | CA         | ESE        |
| <b>THEORY</b>  |  |                |                |   |          |            |               |            |            |
| U19MA406   | Numerical Methods                                  | BSC            | 3              | 1 | 0        | 4          | 40            | 60         | 100        |
| U19EE410   | Linear Integrated Circuits                         | PCC            | 3              | 0 | 0        | 3          | 40            | 60         | 100        |
| U19EE411   | AC Machines  | PCC            | 3              | 0 | 0        | 3          | 40            | 60         | 100        |
| U19EE412   | Transmission and Distribution of Electrical Energy | PCC            | 3              | 0 | 0        | 3          | 40            | 60         | 100        |
| U19EE413   | Control Systems                                    | PCC            | 2              | 2 | 0        | 3          | 40            | 60         | 100        |
| U19CS417   | Data Structures                                    | ESC            | 3              | 0 | 0        | 3          | 40            | 60         | 100        |
| <b>PRACTICAL</b>   |  |                |                |   |          |            |               |            |            |
| U19EE414   | AC Machines Laboratory                             | PCC            | 0              | 0 | 4        | 2          | 60            | 40         | 100        |
| U19EE415   | Linear Integrated Circuits Laboratory              | PCC            | 0              | 0 | 4        | 2          | 60            | 40         | 100        |
| <b>MANDATORY COURSES</b>   |  |                |                |   |          |            |               |            |            |
|  | Mandatory Course - IV                              | MC             | 3              | 0 | 0        | 0          | 100           | --         | 100        |
| <b>Total Credit</b>  |  |                |                |   |          | <b>23</b>  | <b>460</b>    | <b>440</b> | <b>900</b> |

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Signature of the BOS chairman, EEE





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Elayampalayam, Tiruchengode – 637 205





| Programme  | <b>B.E</b>                                      | Programme Code | <b>102</b>     |   |   | Regulation | <b>2019</b>   |            |            |
|--|---|----------------|----------------|---|---|------------|---------------|------------|------------|
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                |   |   | Semester   | <b>V</b>      |            |            |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |   |                |                |   |   |            |               |            |            |
| Course Code  | Course Name                                     | Category       | Periods / Week |   |   | Credit     | Maximum Marks |            |            |
|  |   |                | L              | T | P |            | C             | CA         | ESE        |
| <b>THEORY</b>  |   |                |                |   |   |            |               |            |            |
| U19EE516   | Microprocessors and Microcontrollers            | PCC            | 3              | 0 | 0 | 3          | 40            | 60         | 100        |
| U19EE517   | Power System Protection and Switchgear          | PCC            | 3              | 0 | 0 | 3          | 40            | 60         | 100        |
| U19EE518   | Power System Analysis                           | PCC            | 3              | 1 | 0 | 4          | 40            | 60         | 100        |
| U19EE519   | Power Electronics                               | PCC            | 3              | 0 | 0 | 3          | 40            | 60         | 100        |
|  | Professional Elective-I                         | PEC            | 3              | 0 | 0 | 3          | 40            | 60         | 100        |
|  | Open Elective - I                               | OEC            | 3              | 0 | 0 | 3          | 40            | 60         | 100        |
| <b>PRACTICAL</b>   |   |                |                |   |   |            |               |            |            |
| U19EE520   | Microprocessors and Microcontrollers Laboratory | PCC            | 0              | 0 | 4 | 2          | 60            | 40         | 100        |
| U19EE521   | Control Systems and Instrumentation Laboratory  | PCC            | 0              | 0 | 4 | 2          | 60            | 40         | 100        |
| <b>MANDATORY COURSES</b>   |   |                |                |   |   |            |               |            |            |
|  | Mandatory Course - V                            | MC             | 3              | 0 | 0 | 0          | 100           | --         | 100        |
| <b>Total Credit</b>  |   |                |                |   |   | <b>23</b>  | <b>460</b>    | <b>440</b> | <b>900</b> |

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|--|---|----------------|----------------|---|---|-----------|---|-------------|------------|-------|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     |   |   |           | Regulation  | <b>2019</b> |            |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                |   |   | Semester  | <b>VI</b>   |             |            |       |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |   |                |                |   |   |           |   |             |            |       |
| Course Code  | Course Name   | Category       | Periods / Week |   |   | Credit    | Maximum Marks   |             |            |       |
|  |   |                | L              | T | P |           | C   | CA          | ESE        | Total |
| <b>THEORY</b>  |   |                |                |   |   |           |   |             |            |       |
| U19EE622   | Generation of Electrical Energy   | PCC            | 3              | 0 | 0 | 3         | 40  | 60          | 100        |       |
| U19EE623   | Power System Operation and Control  | PCC            | 3              | 1 | 0 | 4         | 40  | 60          | 100        |       |
| U19HS603   | Principle of Management   | HSC            | 3              | 0 | 0 | 3         | 40  | 60          | 100        |       |
|  | Professional Elective-II  | PEC            | 3              | 0 | 0 | 3         | 40  | 60          | 100        |       |
|  | Open Elective-II  | OEC            | 3              | 0 | 0 | 3         | 40  | 60          | 100        |       |
| <b>PRACTICAL</b>   |   |                |                |   |   |           |   |             |            |       |
| U19EE624   | Power Electronics Laboratory  | PCC            | 0              | 0 | 4 | 2         | 60  | 40          | 100        |       |
| U19EE625   | Power System Simulation Laboratory  | PCC            | 0              | 0 | 4 | 2         | 60  | 40          | 100        |       |
| <b>MANDATORY COURSES</b>   |   |                |                |   |   |           |   |             |            |       |
|  | Mandatory Course - VI   | MC             | 3              | 0 | 0 | 0         | 100   | --          | 100        |       |
| <b>Total Credit</b>  |   |                |                |   |   | <b>20</b> | <b>420</b>  | <b>380</b>  | <b>800</b> |       |

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Signature of the BOS chairman, EEE

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|--|---|----------------|----------------|---|---|------------|---|-------------|------------|-------|
| Programme  | <b>B.E</b>  | Programme Code |                |   |   | <b>102</b> | Regulation  | <b>2019</b> |            |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                |   |   | Semester   | <b>VII</b>  |             |            |       |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |   |                |                |   |   |            |   |             |            |       |
| Course Code  | Course Name   | Category       | Periods / Week |   |   | Credit     | Maximum Marks   |             |            |       |
|  |   |                | L              | T | P |            | C   | CA          | ESE        | Total |
| <b>THEORY</b>  |   |                |                |   |   |            |   |             |            |       |
| U19HS704   | Total Quality Management  | HSC            | 3              | 0 | 0 | 3          | 40  | 60          | 100        |       |
| U19EE726   | Digital Signal Processing   | PCC            | 3              | 0 | 0 | 3          | 40  | 60          | 100        |       |
| U19EE727   | Embedded System   | PCC            | 3              | 0 | 0 | 3          | 40  | 60          | 100        |       |
|  | Professional Elective-III   | PEC            | 3              | 0 | 0 | 3          | 40  | 60          | 100        |       |
|  | Open Elective-III   | OEC            | 3              | 0 | 0 | 3          | 40  | 60          | 100        |       |
| <b>PRACTICAL</b>   |   |                |                |   |   |            |   |             |            |       |
| U19EE728   | Embedded System Laboratory  | PCC            | 0              | 0 | 4 | 2          | 60  | 40          | 100        |       |
| U19EE729   | Internship Training and Mini Project  | EEC            | 0              | 0 | 8 | 4          | 100   | -           | 100        |       |
| <b>MANDATORY COURSES</b>   |   |                |                |   |   |            |   |             |            |       |
|  | Mandatory Course - VII  | MC             | 3              | 0 | 0 | 0          | 100   | --          | 100        |       |
| <b>Total Credit</b>  |   |                |                |   |   | <b>21</b>  | <b>460</b>  | <b>340</b>  | <b>800</b> |       |

CA - Continuous Assessment, ESE - End Semester Examination, PCC – Professional Core Courses , HSC - Humanities and Social Science Courses, PEC - Professional Elective Courses , EEC - Employability Enhancement Courses, OEC-Open Elective Courses, MC-Mandatory courses

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|--|---|----------------|----------------|------------|-------------|---|---------------|------------|------------|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     | Regulation | <b>2019</b> |   |               |            |            |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                | Semester   | <b>VIII</b> |   |               |            |            |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019– 2020 onwards) |   |                |                |            |             |   |               |            |            |
| Course Code  | Course Name   | Category       | Periods / Week |            |             | Credit  | Maximum Marks |            |            |
|  |   |                | L              | T          | P           |   | C             | CA         | ESE        |
| <b>THEORY</b>  |   |                |                |            |             |   |               |            |            |
|  | Professional Elective-IV  | PEC            | 3              | 0          | 0           | 3   | 40            | 60         | 100        |
|  | Professional Elective-V   | PEC            | 3              | 0          | 0           | 3   | 40            | 60         | 100        |
| <b>PRACTICAL</b>   |   |                |                |            |             |   |               |            |            |
| U19EE830   | Project Work & Viva voce  | EEC            | 0              | 0          | 12          | 6   | 60            | 40         | 100        |
| <b>MANDATORY COURSES</b>   |   |                |                |            |             |   |               |            |            |
|  | Mandatory Course - VIII   | MC             | 3              | 0          | 0           | 0   | 100           | --         | 100        |
| <b>Total Credit</b>  |   |                |                |            |             | <b>12</b>   | <b>240</b>    | <b>160</b> | <b>400</b> |

CA - Continuous Assessment, ESE - End Semester Examination, PEC - Professional Elective Courses, EEC - Employability Enhancement Courses, OEC-Open Elective Courses

**Cumulative Course Credit: 165**

**Cumulative Course Credit: 167 #**



# Applicable to the students admitted from the academic year 2022-2023

Signature of the BOS chairman, EEE



**PROFESSIONAL ELECTIVE COURSES:VERTICALS**

| <b>S.No</b> | <b>Sustainable Energy System (VERTICAL- 1)</b> | <b>Converters &amp; Electric Drives (VERTICAL- 2)</b> | <b>Instrumentation &amp; Control (VERTICAL- 3)</b> |
|-------------|--|---|--|
| 1           | U19EEV11<br>HVDC Transmission System           | U19EEV21<br>Solid State Drives                        | U19EEV31-Communication Engineering                 |
| 2           | U19EEV12<br>Power Quality in Power Systems     | U19EEV22<br>Special Electrical Machines               | U19EEV32-Computer Architecture                     |
| 3           | U19EEV13<br>Restructure power system           | U19EEV23<br>Electrical and Hybrid Vehicles            | U19EEV33-Intelligence Techniques                   |
| 4           | U19EEV14<br>Smart Grid Technologies            | U19EEV24<br>Design of Electrical Apparatus            | U19EEV34-Bio Medical Instrumentation               |
| 5           | U19EEV15<br>Flexible AC Transmission Systems   | U19EEV25<br>Wind and Solar Energy Systems             | U19EEV35-Robotics and Control                      |
| 6           | U19EEV16<br>Utilization of Electrical Energy   | U19EEV26<br>Advanced Electric Drives                  | U19EEV36-Modern Control Theory                     |
| 7           | U19EEV17 EHV AC And DC Transmission            | U19EEE27<br>Industrial Electrical Systems             | U19EEV37-PLC & SCADA                               |
| 8           | U19EEV18 Static Relays                         | U19EEV28<br>Power Switching Converters                | U19EEV38-Intellectual Property Rights              |

## VERTICAL I



|                     | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam,<br>Tiruchengode – 637 205 |                |                |   |   |  |               |     |       |  |
|--|---|----------------|----------------|---|---|---|---------------|-----|-------|--|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     |   |   | Regulation <b>2019</b>  |               |     |       |  |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                |   |   | Semester  |               | -   |       |  |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2021- 2022 onwards) |   |                |                |   |   |   |               |     |       |  |
| Course Code  | Course Name   | Category       | Periods / Week |   |   | Credit  | Maximum Marks |     |       |  |
|  |   |                | L              | T | P | C   | CA            | ESE | Total |  |
| <b>THEORY</b>  |   |                |                |   |   |   |               |     |       |  |
| U19EEV11   | HVDC Transmission System  | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV12   | Power Quality in Power Systems  | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV13   | Restructure power system  | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV14   | Smart Grid Technologies   | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV15   | Flexible AC Transmission Systems  | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV16   | Utilization of Electrical Energy  | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV17   | EHV AC And DC Transmission  | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |
| U19EEV18   | Static Relays   | PEC            | 3              | 0 | 0 | 3   | 40            | 60  | 100   |  |

## VERTICAL II

|                     | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam,<br>Tiruchengode – 637 205 |                |                |   |   |                        |  |    |     |       |
|--|---|----------------|----------------|---|---|------------------------|---|----|-----|-------|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     |   |   | Regulation <b>2019</b> |   |    |     |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                |   |   | Semester               |   | -  |     |       |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2021- 2022 onwards) |   |                |                |   |   |                        |   |    |     |       |
| Course Code  | Course Name   | Category       | Periods / Week |   |   | Credit                 | Maximum Marks   |    |     |       |
|  |   |                | L              | T | P |                        | C   | CA | ESE | Total |
| <b>THEORY</b>  |   |                |                |   |   |                        |   |    |     |       |
| U19EEV21   | Solid State Drives  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEV22   | Special Electrical Machines   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEV23   | Electrical and Hybrid Vehicles  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEV24   | Design of Electrical Apparatus  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEV25   | Wind and Solar Energy Systems   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEV26   | Advanced Electric Drives  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEE27   | Industrial Electrical Systems   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |
| U19EEV28   | Power Switching Converters  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60 | 100 |       |



### VERTICAL III



|                     | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam,<br>Tiruchengode – 637 205 |                |                |   |   |                        |  |     |       |  |
|--|---|----------------|----------------|---|---|------------------------|---|-----|-------|--|
| Programme  | <b>B.E</b>  | Programme Code | <b>102</b>     |   |   | Regulation <b>2019</b> |   |     |       |  |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |                |   |   | Semester               | -   |     |       |  |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2021- 2022 onwards) |   |                |                |   |   |                        |   |     |       |  |
| Course Code  | Course Name   | Category       | Periods / Week |   |   | Credit                 | Maximum Marks   |     |       |  |
|  |   |                | L              | T | P | C                      | CA  | ESE | Total |  |
| <b>THEORY</b>  |   |                |                |   |   |                        |   |     |       |  |
| U19EEV31   | Communication Engineering   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV32   | Computer Architecture   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV33   | Intelligence Techniques   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV34   | Bio Medical Instrumentation   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV35   | Robotics and Control  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV36   | Modern Control Theory   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV37   | PLC & SCADA   | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |
| U19EEV38   | Intellectual Property Rights  | PEC            | 3              | 0 | 0 | 3                      | 40  | 60  | 100   |  |

**OPEN ELECTIVE (OE) OFFERED  
DETAILS OF OPEN ELECTIVE (OE) FOR UG COURSE**

| Course Code | Course Name                      | Periods / Week |   |   | Credit | Maximum Marks |     |       |
|-------------|----------------------------------|----------------|---|---|--------|---------------|-----|-------|
|             |                                  | L              | T | P | C      | CA            | ESE | Total |
| U19EEOE1    | Electron Devices                 | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE2    | Electrical Safety                | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE3    | Energy Auditing                  | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE4    | Energy Storage Technologies      | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE5    | Biomass Energy Systems           | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE6    | Energy Efficient Lighting System | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE7    | Soft Computing techniques        | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19EEOE8    | Electrical Systems in industry   | 3              | 0 | 0 | 3      | 40            | 60  | 100   |

**MANDATORY COURSE**

| Course Code | Course Name   | Periods / Week |   |   | Credit | Maximum Marks |     |       |
|-------------|---|----------------|---|---|--------|---------------|-----|-------|
|             |   | L              | T | P | C      | CA            | ESE | Total |
| U19MCFY1    | Environmental Science and Engineering               | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCFY2    | Indian Constitution and Universal Human values      | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCSY3    | Numerical Ability                                   | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCSY4    | Verbal Ability                                      | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCTY5    | Logical Reasoning                                   | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCTY6    | Personality Development                             | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCFY7    | Comprehension on Electricity-Theory and Practice-I  | 3              | 0 | 0 | 0      | 100           | -   | 100   |
| U19MCFY8    | Comprehension on Electricity-Theory and Practice-II | 3              | 0 | 0 | 0      | 100           | -   | 100   |

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|  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR<br/>WOMEN</b><br>(AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI) |  |
|---|---|---|

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**MINOR DEGREE - INTERNET OF THINGS & CLOUD COMPUTING**

| Course Code   | Course Name                        | Category | Periods / Week |   |   | Credit | Maximum Marks |    |     |
|---------------|------------------------------------|----------|----------------|---|---|--------|---------------|----|-----|
|               |                                    |          | L              | T | P |        | C             | CA | ESE |
| <b>THEORY</b> |                                    |          |                |   |   |        |               |    |     |
| U19CSV41      | Embedded Systems                   | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV42      | Smart Sensor Technologies          | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV43      | Security in Computing              | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ITV41      | Software Defined Networks          | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV41      | Fundamentals of Virtualization     | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ITV42      | Information Storage and Management | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV43      | Big Data Tools and Techniques      | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ITV43      | Cloud Computing                    | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**MINOR DEGREE - VERTICAL - CYBER SECURITY**

| Course Code   | Course Name                       | Category | Periods / Week |   |   | Credit | Maximum Marks |    |     |
|---------------|-----------------------------------|----------|----------------|---|---|--------|---------------|----|-----|
|               |                                   |          | L              | T | P |        | C             | CA | ESE |
| <b>THEORY</b> |                                   |          |                |   |   |        |               |    |     |
| U19CSV21      | Information Security              | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV22      | Cyber Security                    | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV23      | Cryptography and Network Security | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV24      | Cyber Law and Ethical Hacking     | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV25      | Social Network Analysis           | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CSV26      | Semantic Web                      | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ITV23      | Cyber Forensics #                 | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV23      | Biometrics Systems#               | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR  
WOMEN**



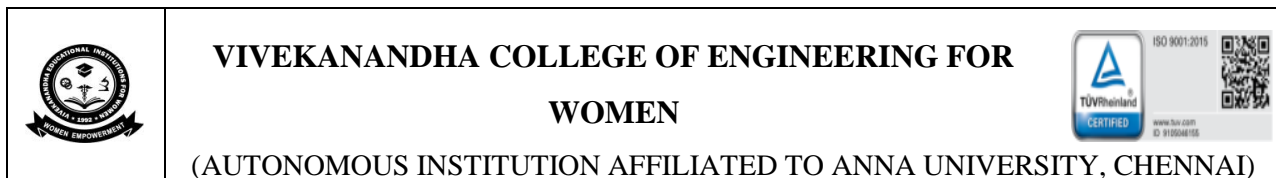
(AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**MINOR DEGREE - VERTICAL - INSTRUMENTATION & CONTROL**

| Course Code   | Course Name                  | Category | Periods / Week |   |   | Credit | Maximum Marks |    |     |
|---------------|------------------------------|----------|----------------|---|---|--------|---------------|----|-----|
|               |                              |          | L              | T | P |        | C             | CA | ESE |
| <b>THEORY</b> |                              |          |                |   |   |        |               |    |     |
| U19EEV31      | Communication Engineering    | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV32      | Computer Architecture        | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV33      | Intelligence Techniques      | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV34      | Bio Medical Instrumentation  | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV35      | Robotics and Control         | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV36      | Modern Control Theory        | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV37      | PLC & SCADA                  | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19EEV38      | Intellectual Property Rights | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |

**Signature of the BOS chairman, EEE**



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**MINOR DEGREE - VERTICAL - ELECTRONICS ENGINEERING AND ADMINISTRATION SYSTEM**

| Course Code   | Course Name                         | Category | Periods / Week |   |   | Credit | Maximum Marks |    |     |
|---------------|-------------------------------------|----------|----------------|---|---|--------|---------------|----|-----|
|               |                                     |          | L              | T | P |        | C             | CA | ESE |
| <b>THEORY</b> |                                     |          |                |   |   |        |               |    |     |
| U19ECV71      | Pattern Recognition                 | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV72      | Medical Electronics                 | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV73      | Remote Sensing                      | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV74      | Automotive Electronics              | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV75      | Industry 4.0                        | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV76      | Digital Video Processing            | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV77      | Principles of Public Administration | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV78      | Administrative Theories             | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ECV79      | Indian Administrative System        | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |

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| <b>Signature of the BOS chairman, EEE</b> |
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**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(AUTONOMOUS INSTITUTION AFFILIATED TO ANNA  
UNIVERSITY, CHENNAI)



**DEPARTMENT OF BIOTECHNOLOGY**

**MINOR DEGREE - VERTICAL - ENTREPRENEURSHIP**

| Course Code | Course Name                                    | Periods / Week |   |   | Credit<br>C | Maximum Marks |     |       |
|-------------|--|----------------|---|---|-------------|---------------|-----|-------|
|             |  | L              | T | P |             | CA            | ESE | Total |
| U19BTV21    | Principles of Management                       | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV22    | Bio-Entrepreneurship                           | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV23    | Industrial Biosafety                           | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV24    | Bioethics & IPR                                | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV25    | Bioindustries & Entrepreneurship               | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV26    | Total Quality management                       | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV27    | Audit and Regulatory Compliance                | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV28    | Biobusiness                                    | 3              | 0 | 0 | 3           | 40            | 60  | 100   |
| U19BTV29    | Resource Management & Lean Start-up Management | 3              | 0 | 0 | 3           | 40            | 60  | 100   |

**Signature of the BOS chairman, EEE**

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|---|--|---|
|  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(AUTONOMOUS INSTITUTION AFFILIATED TO ANNA<br>UNIVERSITY, CHENNAI) |  |
|---|--|---|

**DEPARTMENT OF BIOMEDICAL ENGINEERING**  
**MINOR DEGREE - VERTICAL - HEALTHCARE MANAGEMENT**

| Course Code | Course Name                            | Periods / Week |   |   | Credit | Maximum Marks |     |       |
|-------------|--|----------------|---|---|--------|---------------|-----|-------|
|             |  | L              | T | P | C      | CA            | ESE | Total |
| U19BMV61    | Clinical Engineering                   | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV62    | Hospital Planning and Management       | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV63    | Medical Waste Management               | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV64    | Economics and Management for Engineers | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV65    | Bio Statistics                         | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV66    | Forensic Science in Healthcare         | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV67    | Medical Expert Systems                 | 3              | 0 | 0 | 3      | 40            | 60  | 100   |
| U19BMV68    | Medical Informatics                    | 3              | 0 | 0 | 3      | 40            | 60  | 100   |

Signature of the BOS chairman, EEE





**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(AUTONOMOUS INSTITUTION AFFILIATED TO ANNA  
UNIVERSITY, CHENNAI)





**DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY**

**MINOR DEGREE - VERTICAL - ARTIFICIAL INTELLIGENCE**

| Course Code | Course Name                             | Category | Periods / Week |   |   | Credit | Maximum Marks |    |     |
|-------------|---|----------|----------------|---|---|--------|---------------|----|-----|
|             |   |          | L              | T | P |        | C             | CA | ESE |
| U19CTV31    | Pattern Recognition Techniques          | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV32    | Deep Learning                           | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV33    | Business Intelligent and its Analytics  | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV34    | Data Visualization                      | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV35    | Natural Language Processing             | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV36    | Neuro Fuzzy and Genetic Programming     | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19CTV37    | Knowledge Based Decision Support System | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |
| U19ITV31    | Data Science                            | PEC      | 3              | 0 | 0 | 3      | 40            | 60 | 100 |

**Signature of the BOS chairman, EEE**

|   |  |  |
|---|--|--|
|  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |  |
|---|--|--|



|            |                                     |                |            |            |             |
|------------|-------------------------------------|----------------|------------|------------|-------------|
| Programme  | <b>B.E</b>                          | Programme Code | <b>101</b> | Regulation | <b>2019</b> |
| Department | <b>COMPUTER SCIENCE ENGINEERING</b> |                |            | Semester   | -           |



**CURRICULUM**  
(Applicable to the students admitted from the academic year 2019- 2020 onwards)



**LIST OF OPEN ELECTIVES**

| Course Code | Course Name               | Hours /Week |   |   | Credit | Maximum Marks |     |       |
|-------------|---------------------------|-------------|---|---|--------|---------------|-----|-------|
|             |                           | L           | T | P | C      | CA            | ESE | Total |
| U19CSOE1    | Introduction to IOT       | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE2    | Ethical Hacking           | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE3    | Smart Sensor Technologies | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE4    | Web Designing             | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE5    | Data Analytics            | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE6    | Enterprise Java           | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE7    | Open Source Software      | 3           | 0 | 0 | 3      | 40            | 60  | 100   |
| U19CSOE8    | Python Programming        | 3           | 0 | 0 | 3      | 40            | 60  | 100   |



Signature of the BOS chairman, EEE



|                     | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |               |            |            |  |               |    |     |
|---|--|---------------|------------|------------|---|---------------|----|-----|
| Programme   | <b>B.E</b>   | ProgrammeCode | <b>107</b> | Regulation | <b>2019</b>   |               |    |     |
| Department  | <b>COMPUTER SCIENCE AND TECHNOLOGY</b>   |               |            | Semester   | <b>-</b>  |               |    |     |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019- 2020onwards) |  |               |            |            |   |               |    |     |
| <b>LIST OF OPEN ELECTIVES</b>   |  |               |            |            |   |               |    |     |
| Course Code   | Course Name  | Hours /Week   |            |            | Credit  | Maximum Marks |    |     |
|   |  | L             | T          | P          |   | C             | CA | ESE |
| U19CTOE1  | Fundamentals of Artificial Intelligence  | 3             | 0          | 0          | 3   | 40            | 60 | 100 |
| U19CTOE2  | Fundamentals of Information Security   | 3             | 0          | 0          | 3   | 40            | 60 | 100 |
| U19CTOE3  | Fundamentals of Data Science   | 3             | 0          | 0          | 3   | 40            | 60 | 100 |
| U19CTOE4  | Fundamentals of Machine Learning   | 3             | 0          | 0          | 3   | 40            | 60 | 100 |
| U19CTOE5  | Fundamentals of Data Visualization   | 3             | 0          | 0          | 3   | 40            | 60 | 100 |
| U19CTOE6  | Computer Forensics   | 3             | 0          | 0          | 3   | 40            | 60 | 100 |



|                      | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |                |            |            |  |               |    |     |
|--|--|----------------|------------|------------|---|---------------|----|-----|
| Programme  | <b>B.Tech.</b>   | Programme Code | <b>104</b> | Regulation | <b>2019</b>   |               |    |     |
| Department   | <b>INFORMATION TECHNOLOGY</b>  |                |            | Semester   | -   |               |    |     |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019- 2020 onwards) |  |                |            |            |   |               |    |     |
| <b>LIST OF OPEN ELECTIVES</b>  |  |                |            |            |   |               |    |     |
| Course Code  | Course Name  | Hours /Week    |            |            | Credit  | Maximum Marks |    |     |
|  |  | L              | T          | P          |   | C             | CA | ESE |
| U19ITOE1   | Mobile application development   | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE2   | Robotics   | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE3   | Basics of Cloud Computing  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE4   | Introduction to Data Structures  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE5   | Cyber Security   | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE6   | Information Technology Essentials  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE7   | Business intelligence and its Applications   | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE8   | Internet of Things   | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE9   | Introduction to Java Programming   | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE10  | Introduction to R Programming  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE11  | Ethical Hacking  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE12  | Cyber Forensics  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |
| U19ITOE13  | E Learning Techniques  | 3              | 0          | 0          | 3   | 40            | 60 | 100 |

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|---|--|----------------|----------------|---|---|--------|---------------|----------------------|-----|-------|
| Programme   | <b>B.E.,</b>   | Programme Code | <b>103</b>     |   | Regulation  |        |               | <b>2019</b>          |     |       |
| Department  | <b>ELECTRONICS AND COMMUNICATION ENGINEERING</b>   |                |                |   | Semester  |        |               | <b>OPEN ELECTIVE</b> |     |       |
| <b>LIST OF OPEN ELECTIVE</b>  |  |                |                |   |   |        |               |                      |     |       |
| Course Code   | Course Name  | Category       | Periods / Week |   |   | Credit | Maximum Marks |                      |     |       |
|   |  |                | L              | T | P   |        | C             | CA                   | ESE | Total |
| <b>OPEN ELECTIVE-I</b>  |  |                |                |   |   |        |               |                      |     |       |
| U19ECO1   | Speech Processing  | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| U19ECO2   | Biomedical Instrumentation   | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| U19ECO3   | Automotive Electronics   | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| <b>OPEN ELECTIVE-II</b>   |  |                |                |   |   |        |               |                      |     |       |
| U19ECO4   | Satellite Communication  | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| U19ECO5   | VLSI Design and Its Applications   | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| U19ECO6   | Digital Image Processing   | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| <b>OPEN ELECTIVE-III</b>  |  |                |                |   |   |        |               |                      |     |       |
| U19ECO7   | Basics of Communication Systems  | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| U19ECO8   | Wireless Sensor Networks   | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |
| U19ECO9   | PCB Design and Fabrication   | OE             | 3              | 0 | 0   | 3      | 40            | 60                   | 100 |       |

Signature of the BOS chairman, EEE



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|---|---|----------------|----------------|---|------------|---|---------------|----|-----|
| Programme   | <b>B.E.</b>   | Programme Code | <b>106</b>     |   | Regulation | <b>2019</b>   |               |    |     |
| Department  | <b>BIOMEDICAL ENGINEERING</b>   |                |                |   | Semester   | <b>OPEN ELECTIVE</b>  |               |    |     |
| <b>CURRICULUM</b>   |   |                |                |   |            |   |               |    |     |
| <b>LIST OF OPEN ELECTIVES</b>   |   |                |                |   |            |   |               |    |     |
| Course Code   | Course Name   | Category       | Periods / Week |   |            | Credit  | Maximum Marks |    |     |
|   |   |                | L              | T | P          |   | C             | CA | ESE |
| <b>OPEN ELECTIVE-I</b>  |   |                |                |   |            |   |               |    |     |
| U19BMOE1  | Biotelemetry  | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| U19BMOE2  | Virtual Instrumentation   | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| U19BMOE3  | Hospital Waste Management   | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| <b>OPEN ELECTIVE-II</b>   |   |                |                |   |            |   |               |    |     |
| U19BMOE4  | Medical Robotics  | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| U19BMOE5  | Healthcare Management Systems   | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| U19BMOE6  | Biometric Systems and Their Applications  | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| <b>OPEN ELECTIVE-III</b>  |   |                |                |   |            |   |               |    |     |
| U19BMOE7  | Basics of Biomedical Instrumentation  | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| U19BMOE8  | Medical Informatics   | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |
| U19BMOE9  | ICU and Operation Theatre Equipments  | OE             | 3              | 0 | 0          | 3   | 40            | 60 | 100 |

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|--|--|----------------|------------|------------|---|---------------|-----|-------|
| Programme  | <b>B.Tech.</b>   | Programme Code | <b>105</b> | Regulation | <b>2019</b>   |               |     |       |
| Department   | <b>BIOTECHNOLOGY</b>   |                |            | Semester   | -   |               |     |       |
| <b>CURRICULUM</b><br>(Applicable to the students admitted from the academic year 2019- 2020 onwards) |  |                |            |            |   |               |     |       |
| <b>LIST OF OPEN ELECTIVES</b>  |  |                |            |            |   |               |     |       |
| Course Code  | Course Name  | Hours /Week    |            |            | Credit  | Maximum Marks |     |       |
|  |  | L              | T          | P          | C   | CA            | ESE | Total |
| <b>OPEN ELECTIVE-I</b>   |  |                |            |            |   |               |     |       |
| U19BTOE1   | Biology for Engineers  | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| U19BTOE2   | Biofuels and Bio energy  | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| U19BTOE3   | Bio-Business   | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| <b>OPEN ELECTIVE-II</b>  |  |                |            |            |   |               |     |       |
| U19BTOE4   | Basics of Bioinformatics   | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| U19BTOE5   | Human Health and Nutritional Disorders   | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| U19BTOE6   | Waste Management   | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| <b>OPEN ELECTIVE-III</b>   |  |                |            |            |   |               |     |       |
| U19BTOE7   | Food Processing and Preservation Technology  | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| U19BTOE8   | Forensic Technology  | 3              | 0          | 0          | 3   | 40            | 60  | 100   |
| U19BTOE9   | Biodiversity and Bioprospecting  | 3              | 0          | 0          | 3   | 40            | 60  | 100   |

|  |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
|--|--|------------------|------|------|------------|--|-----------------|-------|------|-------|-------|----------------|-----------------------|-------|-------|-------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| Programme  | <b>B.E.</b>  | Programme Code   |      |      | <b>102</b> | Regulation   | <b>2019</b>     |       |      |       |       |                |                       |       |       |       |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |                  |      |      | Semester   |  | <b>I</b>        |       |      |       |       |                |                       |       |       |       |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit     | Maximum Marks  |                 |       |      |       |       |                |                       |       |       |       |
|  |  | L                | T    | P    | C          | CA   | ESE             | Total |      |       |       |                |                       |       |       |       |
| <b>U19MA101</b>  | <b>Calculus *</b>  | 3                | 1    | 0    | 4          | 60   | 40              | 100   |      |       |       |                |                       |       |       |       |
| <b>Course Objective</b>  | The students should made to  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
|  | <ul style="list-style-type: none"> <li>• Provide the information about Review of limits, continuity and differentiability.</li> <li>• Understand maxima and minima of functions of two variables.</li> <li>• Demonstrate Integral calculus.</li> <li>• Identify the problems based on area, surface and volume.</li> <li>• To recognize the Second order linear differential equations.</li> </ul> |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |      |      |            |  | Knowledge level |       |      |       |       |                |                       |       |       |       |
|  | <b>CO1:</b> Apply Mean value theorem and Taylor's theorem.   |                  |      |      |            |  | K1,K3           |       |      |       |       |                |                       |       |       |       |
|  | <b>CO2:</b> Analyze Total derivative.  |                  |      |      |            |  | K2,K4           |       |      |       |       |                |                       |       |       |       |
|  | <b>CO3:</b> Formulate Reduction Formulae.  |                  |      |      |            |  | K3,K5           |       |      |       |       |                |                       |       |       |       |
|  | <b>CO4:</b> Translate Change of order of integration.  |                  |      |      |            |  | K2,K5           |       |      |       |       |                |                       |       |       |       |
| <b>CO5:</b> Apply method of variation of parameters.   |  |                  |      |      |            | K3,K5  |                 |       |      |       |       |                |                       |       |       |       |
| <b>Pre-requisites</b>  | -  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |      |      |            |  |                 |       |      |       |       |                | <b>CO/PSO Mapping</b> |       |       |       |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5       | PO 6   | PO 7            | PO 8  | PO 9 | PO 10 | PO 11 | PO 12          | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3  | 3                |      |      |            |  |                 |       |      |       |       |                | 2                     |       |       |       |
| CO 2   | 3  | 3                |      |      |            |  |                 |       |      |       |       |                | 2                     |       |       |       |
| CO 3   | 3  | 3                |      |      |            |  |                 |       |      |       |       |                | 2                     |       |       |       |
| CO 4   | 3  | 3                |      |      |            |  |                 |       |      |       |       |                | 2                     |       |       |       |
| CO 5   | 3  | 3                |      |      |            |  |                 |       |      |       |       |                | 2                     |       |       |       |
| <b>Course Assessment Methods</b>   |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>Direct</b>  |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp; III</li> <li>2. Assignment.</li> <li>3. End-Semester examinations</li> </ol>  |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>Indirect</b>  |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <ol style="list-style-type: none"> <li>1. Course – end survey</li> </ol>   |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>Content of the syllabus</b>   |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |
| <b>Unit – I</b>  | <b>DIFFERENTIAL CALCULUS</b>   |                  |      |      |            |  |                 |       |      |       |       | <b>Periods</b> | <b>12</b>             |       |       |       |
| Limit, continuity, differentiability , rules of differentiation, differentiation of various functions, Rolle's theorem(excludingproof),Meanvalueththeorem(excludingproof),Taylor'stheorem(excludingproof), Maxima and Minima, Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay ofradioactivematerials–Chemicalreactionsandsolutions,Ohm'slaw,Kirchoff'slaw-Simpleelectriccircuit problems) |  |                  |      |      |            |  |                 |       |      |       |       |                |                       |       |       |       |



|  |   |                |           |
|--|---|----------------|-----------|
| <b>Unit - II</b>   | <b>FUNCTIONS OF SEVERAL VARIABLES</b>   | <b>Periods</b> | <b>12</b> |
| Partial differentiation – Homogeneous functions and Euler’s theorem (excluding proof) – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables (excluding proof) – Maxima and minima of functions of two variables .  |   |                |           |
| <b>Unit – III</b>  | <b>INTEGRAL CALCULUS</b>  | <b>Periods</b> | <b>12</b> |
| Riemann integral- Fundamental theorem of calculus (excluding proof) - methods of integration (Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions) - Reduction formula on $\int_0^{\frac{\pi}{2}} \cos^n x dx$ , $\int_0^{\frac{\pi}{2}} \sin^n x dx$ . |   |                |           |
| <b>Unit - IV</b>   | <b>MUTIPLE INTEGRALS</b>  | <b>Periods</b> | <b>12</b> |
| Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.  |   |                |           |
| <b>Unit – V</b>  | <b>ORDINARY DIFFERENTIAL EQUATIONS</b>  | <b>Periods</b> | <b>12</b> |
| Second order Linear ordinary differential equations with constant coefficients, Cauchy’s-Euler equations (excluding proof)- Legendre’s Linear differential equations (excluding proof) - Method of variation of parameters.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>60</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Stewart, J. Calculus: Early Transcendentals (8 <sup>th</sup> Edition), Cengage Learning, 2015.            |                |           |
| 2.   | Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.          |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Kreyszig E, Advanced Engineering Mathematics (10 <sup>th</sup> Edition), John Wiley (2015).               |                |           |
| 2.   | Boyce W E and DiPrima R, Elementary Differential Equations (9 <sup>th</sup> Edition), John Wiley (2005).  |                |           |
| 3.   | Nishant Shukla, Elementary Integral Calculus  |                |           |
| 4.   | Anton H, Calculus: Early Transcendentals, 10th Edition, Wiley (2012).                                     |                |           |
| 5.   | B V Ramana, Higher Engineering Mathematics, Tata McGraw Hill Education Pvt Ltd., New Delhi (2012)         |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://freevideolectures.com">https://freevideolectures.com</a> › All Courses › Calculus › UCLA |                |           |
| 2.   | <a href="http://www.learnerstv.com">www.learnerstv.com</a> /Free-engineering-Video-lectures               |                |           |
| 3.   | <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>  |                |           |

|   |  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
|---|--|------------------|------|------|--------|---------------|------------|------------|-------|-------|---|-------|-----------------------|-------|-------|-------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |      |      |        |               |            |            |       |       |  |       |                       |       |       |       |
| Programme   | <b>B.E.</b>  | Programme Code   |      |      |        |               | <b>102</b> | Regulation |       |       | <b>2019</b>   |       |                       |       |       |       |
| Department  | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |                  |      |      |        | Semester      |            |            |       |       | <b>I</b>  |       |                       |       |       |       |
| Course Code   | Course Name  | Periods Per Week |      |      | Credit | Maximum Marks |            |            |       |       |   |       |                       |       |       |       |
|   |  | L                | T    | P    | C      | CA            |            | ESE        | Total |       |   |       |                       |       |       |       |
| <b>U19EN101</b>   | <b>English for Communication – I</b>   | 3                | 0    | 0    | 3      | 60            |            | 40         | 100   |       |   |       |                       |       |       |       |
| Course Objective  | The students should made to  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
|   | <ul style="list-style-type: none"> <li>• make learners listen to audio files and replicate it in speaking contexts.</li> <li>• Make learners read widely in order to practice writing</li> <li>• Make learners develop vocabulary and strengthen grammatical understanding</li> <li>• Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning.</li> <li>• Identify and begin to apply the language features of academic and professional writing and speaking</li> </ul> |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
| Course Outcome  | At the end of the course, the student should be able to,   |                  |      |      |        |               |            |            |       |       |   |       | Knowledge level       |       |       |       |
|   | CO1: Speak adequately from the inputs they gained through listening.   |                  |      |      |        |               |            |            |       |       |   |       | K1,K3                 |       |       |       |
|   | CO2:Write appropriately based on the knowledge gained through reading of a variety of materials  |                  |      |      |        |               |            |            |       |       |   |       | K2,K4                 |       |       |       |
|   | CO3:Use language through their grammatical acquisition and their knowledge about using right word at the right context.  |                  |      |      |        |               |            |            |       |       |   |       | K3,K5                 |       |       |       |
|   | CO4:Listen the accents and tones of the language properly.   |                  |      |      |        |               |            |            |       |       |   |       | K2,K5                 |       |       |       |
| Pre-requisites  | -  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
|   | <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1-Weak   |                  |      |      |        |               |            |            |       |       |   |       | <b>CO/PSO Mapping</b> |       |       |       |
| COs   | Programme Outcomes (POs)   |                  |      |      |        |               |            |            |       |       |   |       | PSOs                  |       |       |       |
|   | PO 1   | PO 2             | PO 3 | PO 4 | PO 5   | PO 6          | PO 7       | PO 8       | PO 9  | PO 10 | PO 11   | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  |  |                  |      |      | 2      |               |            | 3          | 3     |       | 3   | 3     |                       |       |       |       |
| CO 2  |  |                  |      |      | 2      |               |            | 3          | 3     |       | 3   | 3     |                       |       |       |       |
| CO 3  |  |                  |      |      | 2      |               |            | 3          | 3     |       | 3   | 3     |                       |       |       |       |
| CO 4  |  |                  |      |      | 2      |               |            | 3          | 3     |       | 3   | 3     |                       |       |       |       |
| CO 5  |  |                  |      |      | 2      |               |            | 3          | 3     |       | 3   | 3     |                       |       |       |       |
| <b>Course Assessment Methods</b>  |  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
| <b>Direct</b>   |  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp; III</li> <li>2. Assignment: Simulation using tool</li> <li>3. End-Semester examinations</li> </ol> |  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
| <b>Indirect</b>   |  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |
| <ol style="list-style-type: none"> <li>1. Course - end survey</li> </ol>  |  |                  |      |      |        |               |            |            |       |       |   |       |                       |       |       |       |

Signature of the BOS chairman, EEE

| Content of the syllabus  |  |                |                      |
|--|--|----------------|----------------------|
| <b>Unit – I</b>  |  | <b>Periods</b> | <b>9</b>             |
| <b>Listening</b> -Introduction to Different Types of Listening, Listening to Casual Conversations, <b>Speaking</b> -Introduction to develop the Art of Speaking, Giving Self Introduction, <b>Reading</b> -Understanding the Basics of Reading Skills, Reading Instructions and Technical Manuals, <b>Writing</b> Introduction to writing strategies, Writing Definitions, <b>Focus on Language</b> - Technical terms (Jargon), Word Formation with Prefixes and Suffixes, Using Active Voice and Passive Voice, Basic sentence patterns, Tenses (past, present, perfect and continuous tenses). |  |                |                      |
| <b>Unit – II</b>   |  | <b>Periods</b> | <b>9</b>             |
| <b>Listening</b> - Listening to lectures, listening to description of equipment, <b>Speaking</b> - Strategies for Developing Conversational Skills, Short Conversations through Role Play Activities, <b>Reading</b> - Reading Comprehension, Reading e-mails, Reading Headlines, Predicting the Content, <b>Writing</b> - Note making, Writing Descriptions, <b>Focus on Language</b> - Collocations, Functional Use of Tenses, Subject - verb agreement.   |  |                |                      |
| <b>Unit - III</b>  |  | <b>Periods</b> | <b>9</b>             |
| <b>Listening</b> - Listening to different kinds of interviews (Face - to - face, radio, TV and telephone interviews), <b>Speaking</b> - Describing an Object, Asking Questions, Participating in Discussions <b>Reading</b> - Intensive reading, Reading passages for gist. <b>Writing</b> - Informal writing -short e-mails with emphasis on Brevity, Clarity, Coherence and Cohesion), <b>Focus on Language</b> - Sequential Connectives, Impersonal Passive   |  |                |                      |
| <b>Unit - IV</b>   |  | <b>Periods</b> | <b>9</b>             |
| <b>Listening</b> -Note Taking, <b>Speaking</b> - Improving Fluency through Narration. <b>Reading</b> -Reading passages for specific information- Phone messages, Reading and Transferring Information. <b>Writing</b> - Effective writing strategies, Informal writing, Writing a Memo, <b>Focus on Language</b> - Pronunciation Practice (Phonetic sounds - Vowels, Consonants and Diphthongs), Cause and Effect, Conditional Statements (if - clauses and types), Usage of Modal Verbs.  |  |                |                      |
| <b>Unit - V</b>  |  | <b>Periods</b> | <b>9</b>             |
| <b>Listening</b> - Listening to understand Modulation, Listening to Welcome Speeches, <b>Speaking</b> - Delivering Welcome Address, Understanding Segmental and Suprasegmental Features-Practicing Stress, Pause and Intonation, <b>Reading</b> - Reading for a purpose, Reading Business Documents, Interpreting Charts and Graphs., <b>Writing</b> - Writing Business e-mails, Describing a Process. <b>Focus on Language</b> -Synonyms and Antonyms, Common Errors in English.  |  |                |                      |
|  |  |                | <b>Total Periods</b> |
|  |  |                | <b>45</b>            |

| Text Books:  |   |
|--------------|---|
| 1.           | Sumant. S, Pereira Joyce, Shameem.M, Selvarajan.R-English Communication Skills,Vijay Nicole imprints Pvt.Ltd, 2015.   |
| 2.           | Sokkaalingam, S.RM., The Art Of Speaking English Versatile Publishing House,2018.   |
| References:  |   |
| 1.           | Dr. Padma Ravindran, Poorvadevi, M. Y. Abdur Razack- English for life, English for work, students Book, Ebek language laboratory pvt ltd, 2011.                 |
| 2.           | DuttRajeevan, Prakash. A Course in Communication Skill (Anna University, Coimbatore edition): Cambridge University Press India Pvt.Ltd, 2007.                   |
| 3.           | S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering, Orient Blackswan Pvt, Ltd, 2009.                                       |
| 4.           | Technical English – I & II, Sonaversity, Sona College of Technology, Salem, First Edition, 2012.  |
| 5.           | Meenakshmi Raman and Sangeeta Sharma- „Technical communication English Skills for Engineers; oxford University Press, 2008.                                     |
| E-Resources. |   |
| 1            | <a href="http://www.sparknotes.com/lit/the-alchemist/summary.html">http://www.sparknotes.com/lit/the-alchemist/summary.html</a>                                 |
| 2            | <a href="https://www.stephencovey.com/7habits/7habits.php">https://www.stephencovey.com/7habits/7habits.php</a>   |
| 3            | <a href="http://en.wikipedia.org/wiki/The_Seven_Habits_of_Highly_Effective_People">http://en.wikipedia.org/wiki/The_Seven_Habits_of_Highly_Effective_People</a> |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(Autonomous Institution Affiliated to Anna University, Chennai)  
Elayampalayam, Tiruchengode – 637 205



|  |   |                  |            |            |             |               |                 |       |
|--|---|------------------|------------|------------|-------------|---------------|-----------------|-------|
| Programme  | <b>B.E.</b>   | Programme code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |       |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>I</b>    |               |                 |       |
| Course code  | Course name   | Periods per week |            |            | Credit      | Maximum Marks |                 |       |
|  |   | L                | T          | P          | C           | CA            | ESE             | Total |
| <b>U19CH105</b>  | <b>Engineering Chemistry</b>  | 3                | 0          | 0          | 3           | 60            | 40              | 100   |
| <b>Course Objective</b>  | <p>The students should made to</p> <ul style="list-style-type: none"> <li>To recognize the basic technology requirements in water treatment</li> <li>To gain knowledge in Polymeric materials towards engineering application.</li> <li>To enrich the Knowledge of the students with the basics of Nano materials, their properties and applications.</li> <li>Familiarize about the renewable energy and different types of batteries in the Engineering application.</li> <li>Gain knowledge in destruction of metals and protection for engineering applications.</li> </ul> |                  |            |            |             |               |                 |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |            |            |             |               | Knowledge Level |       |
|  | <b>CO1:</b> Implement innovative solutions in <b>waste water</b> treatment process.   |                  |            |            |             |               | K3              |       |
|  | <b>CO2:</b> Identify the applications of a specific polymer in the field of engineering.  |                  |            |            |             |               | K2              |       |
|  | <b>CO3:</b> Forecast the information of Nano particles and their industrial applications  |                  |            |            |             |               | K2              |       |
|  | <b>CO4:</b> Recognize the renewable energy devices <b>for</b> sustainable energy.   |                  |            |            |             |               | K3              |       |
| <b>CO5:</b> Identify the rate of corrosion of a metal in a given environment and find out appropriate control techniques to avoid corrosion. |   |                  |            |            |             |               |                 |       |
| Pre-Requisites   | <b>Nil</b>  |                  |            |            |             |               |                 |       |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |
| <b>CO 1</b>   | 3                        | 3    | 2    | 2    |      | 2    | 2    |      |      |       | 1     | 2     | 1              | 1     | 2     |       |
| <b>CO 2</b>   | 3                        | 2    | 2    | 1    |      | 2    | 2    |      |      |       | 1     | 1     | 2              | 2     | 2     |       |
| <b>CO 3</b>   | 3                        | 2    | 3    | 2    | 1    | 2    | 1    |      |      |       | 1     | 1     | 1              | 1     | 1     |       |
| <b>CO 4</b>   | 3                        | 3    | 2    | 2    | 2    | 3    | 3    |      |      |       | 1     | 2     | 3              | 2     | 2     |       |
| <b>CO 5</b>   | 3                        | 3    | 2    | 2    | 1    | 3    | 2    |      |      |       | 2     | 2     | 1              | 1     | 2     |       |

#### Course Assessment Methods



##### Direct

- 1.Continuous Assessment Test I, II & III
- 2.Assignment: Simulation using tool
- 3.End-Semester examinations

##### Indirect


1. Course - end survey

| <b>Content of the syllabus</b>  |   |                      |           |
|---|---|----------------------|-----------|
| <b>Unit - I</b>   | <b>WATER TECHNOLOGY</b>   | <b>Periods</b>       | <b>9</b>  |
| Introduction-Sources and impurities in Water, Soft and Hard water, Water quality parameters, Types of Hardness – Determination of Hardness by EDTA method, Domestic Water Treatment. Boiler Feed Water –Requisites, Problems due to hard water in boilers - Scale and Sludge formation in boilers-Caustic Embrittlement-Boiler corrosion, Treatment of boiler feed Water – Internal conditioning (Carbonate, Phosphate, and Calgon conditioning) External conditioning – Ion exchange process, Zeolite process, Brackish water –Water purification by Reverse osmosis                             |   |                      |           |
| <b>Unit - II</b>  | <b>POLYMER CHEMISTRY</b>  | <b>Periods</b>       | <b>9</b>  |
| Introduction - Occurrence, definitions – Functionality - Degree of Polymerization, Classification of polymers – structure (Linear, Branched & network polymer structure) block, random & graft copolymers, properties of polymers, Tacticity, Tg, molecular weight - number and weight average method. Types of polymerizations: Addition, condensation and copolymerization. Mechanism of polymerization: Addition - Free radical, cationic and anionic polymerization). Preparation, properties and applications of PE, PMMA, PC, nylon6, nylon 66, PET, and Bakelite..                         |   |                      |           |
| <b>Unit - III</b>   | <b>NANO CHEMISTRY</b>   | <b>Periods</b>       | <b>9</b>  |
| Basics- distinction between molecules, nano particles and bulk materials; size dependent properties. Nano particles: Nano cluster, nano rod, nan otube (CNT) and nano wires. Synthesis: Sol-gel, Precipitation, Thermolysis - hydrothermal, solvothermal, Electro deposition, Spray Pyrolysis, Chemical Vapour deposition, Laser ablation; Properties and applications of Nano materials in medical and electronic devices  |   |                      |           |
| <b>Unit - IV</b>  | <b>RENEWABLE ENERGY AND STORAGE DEVICES</b>   | <b>Periods</b>       | <b>9</b>  |
| Renewable energy and its sources - Solar Energy - Photo voltaic cells, Importance of Solar cells - p-n junctions in Solar cells - Working of Photovoltaic cell, Recent advances in solar cell materials, Wind energy - Types of Wind Power Plants (WPPs), Components and working of WPPs, Tidal energy - Types of Tidal power plants (TPPs), Barrage and Non-Barrage Tidal power systems.<br>Batteries and fuel cells: Types of batteries - Dry cells-Alkaline battery, lead storage battery, Ni-Cd battery, lithium battery, Fuel cell - H <sub>2</sub> -O <sub>2</sub> fuel cell-applications.. |   |                      |           |
| <b>Unit - V</b>   | <b>CORROSION AND ITS CONTROL</b>  | <b>Periods</b>       | <b>9</b>  |
| Introduction, Types of corrosion - chemical and electrochemical corrosion, mechanism, Pilling -Bedworth rule, Types of electrochemical corrosion – Galvanic corrosion, Pitting corrosion, Crevice corrosion, Corrosion on wire fence and Pipeline corrosion, Factors influencing rate of corrosion, corrosion control methods – Sacrificial anode and impressed cathodic current.<br>Protective coatings – Paints: constituents and functions, Metallic coatings - steps involved in cleaning the surface for Electroplating, Electroplating (Au), Electro less plating (Ni).                     |   |                      |           |
|   |   | <b>Total Periods</b> | <b>45</b> |
| <b>Text Books:</b>  |   |                      |           |
| 1.  | O.G.Palanna, “Engineering Chemistry “Tata Mc GrawHill PVT,Ltd. Second Edition -2017   |                      |           |
| 2.  | Dr.S.Vairam ,Dr.S.Mageswari,Dr.K.Balachandran, Engineering Chemistry : First Edition, Wiley publication,Reprint-2016  |                      |           |
| <b>References:</b>  |   |                      |           |
| 1.  | Engineering Chemistry: Jain & Jain, Dhanpat Rai Publishing Company Edition- 16- 2015.   |                      |           |
| 2.  | Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, Published by S. Chand & Company Ltd, 2014  |                      |           |
| 3.  | Puri, Sharma and Pathnia, Physical Chemistry-II, Vishal Publishers,.Edition- 2019.  |                      |           |
| 4.  | Engineering Chemistry: Sashi Chawla, Dhanpat Rai & Co (pvt.)ltd. Edition- 5- 2013.  |                      |           |
| 5.  | Dr.S.Vairam ,Dr.Suba Ramesh, Engineering Chemistry: First Edition, Wiley publication,Reprint-2016   |                      |           |
| <b>E-Resources.</b>   |   |                      |           |
| 1   | <a href="https://www.who.int/water_sanitation_health/dwq/arsenicun6.pdf">https://www.who.int/water_sanitation_health/dwq/arsenicun6.pdf</a>   |                      |           |
| 2   | <a href="https://www.schandpublishing.com/books/tech-professional/applied-science/a-textbook-polymer-chemistry/9788121941129/#.XdZ214MzY2w">https://www.schandpublishing.com/books/tech-professional/applied-science/a-textbook-polymer-chemistry/9788121941129/#.XdZ214MzY2w</a> |                      |           |
| 3   | <a href="https://www.elsevier.com/books/nanochemistry/klabunde/978-0-444-59397-9">https://www.elsevier.com/books/nanochemistry/klabunde/978-0-444-59397-9</a>   |                      |           |

|   |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
|---|--|--|------------------|------|------|--------|---------------|------------|-------|----------|-------------|---|-----------------------|-------|-----------------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |  |                  |      |      |        |               |            |       |          |             |  |                       |       |                 |
| Programme   | <b>B.E.</b>  |  | Programme Code   |      |      |        | <b>102</b>    | Regulation |       |          | <b>2019</b> |   |                       |       |                 |
| Department  | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |  |                  |      |      |        | Semester      |            |       | <b>I</b> |             |   |                       |       |                 |
| Course Code   | Course Name  |  | Periods Per Week |      |      | Credit | Maximum Marks |            |       |          |             |   |                       |       |                 |
|   |  |  | L                | T    | P    | C      | CA            | ESE        | Total |          |             |   |                       |       |                 |
| <b>U19CS101</b>   | <b>Programming for Problem Solving</b>   |  | 3                | 0    | 0    | 3      | 60            | 40         | 100   |          |             |   |                       |       |                 |
| <b>Course Objective</b>   | The students should made to  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
|   | <ul style="list-style-type: none"> <li>Learn the fundamentals of computers and acquire problem solving skills</li> <li>Understand C programming concepts</li> <li>Write the programs using arrays and strings</li> <li>Write the programs using functions</li> <li>Write the programs using structures.</li> </ul> |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
|   | At the end of the course, the student should be able to,   |  |                  |      |      |        |               |            |       |          |             |   |                       |       | Knowledge Level |
|   | <b>CO1:</b> Write the algorithms and to draw flowcharts for solving problems.  |  |                  |      |      |        |               |            |       |          |             |   |                       |       | K3              |
|   | <b>CO2:</b> Analyze the basics of C programming language.  |  |                  |      |      |        |               |            |       |          |             |   |                       |       | K4              |
| <b>CO3:</b> Implement the C programs using arrays and strings.  |  |  |                  |      |      |        |               |            |       |          |             |   |                       | K4    |                 |
| <b>CO4:</b> Develop C programs using the functions and pointers.  |  |  |                  |      |      |        |               |            |       |          |             |   |                       | K3    |                 |
| <b>CO5:</b> Solve the real time problems using Structures and union   |  |  |                  |      |      |        |               |            |       |          |             |   |                       | K3    |                 |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |  |  |                  |      |      |        |               |            |       |          |             |   | <b>CO/PSO Mapping</b> |       |                 |
| <b>COs</b>  | <b>Programme Outcomes (POs)</b>  |  |                  |      |      |        |               |            |       |          |             |   | <b>PSOs</b>           |       |                 |
|   | PO 1   | PO 2                                   | PO 3             | PO 4 | PO 5 | PO 6   | PO 7          | PO 8       | PO 9  | PO 10    | PO 11       | PO 12   | PSO 1                 | PSO 2 | PSO 3           |
| <b>CO 1</b>   | 3  | 3                                      | 3                |      | 2    |        |               | 3          | 3     | 3        | 3           | 2   | 3                     |       |                 |
| <b>CO 2</b>   | 3  | 3                                      | 3                |      | 2    |        |               | 3          | 3     | 3        | 3           | 2   | 3                     |       |                 |
| <b>CO 3</b>   | 3  | 3                                      | 3                |      | 2    |        |               | 3          | 3     | 3        | 3           | 2   | 3                     |       |                 |
| <b>CO 4</b>   | 3  | 3                                      | 3                | 2    | 2    |        |               | 3          | 3     | 3        | 3           | 2   | 3                     |       |                 |
| <b>CO 5</b>   | 3  | 3                                      | 3                | 3    | 2    |        |               | 3          | 3     | 3        | 3           | 2   | 3                     | 3     |                 |
| <b>Course Assessment Methods</b>  |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| <b>Direct</b>   |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| 1. Continuous Assessment Test I, II & III   |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| 2. Assignment   |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| 3. End-Semester examinations  |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| <b>Indirect</b>   |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| 1. Course - end survey  |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| <b>Content of the syllabus</b>  |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |
| <b>Unit – I</b>   |  | <b>INTRODUCTION TO PROBLEM SOLVING</b> |                  |      |      |        |               |            |       |          |             | Periods   | <b>9</b>              |       |                 |
| Basic Organization of Computer - Programming Languages- Flowchart – Pseudocode - Compilers-Interpreter-Algorithm - Building Blocks of Algorithm - Algorithmic Problem Solving-Simple Strategies for Developing Algorithms - Illustrative Problems: Find Minimum value from list of elements, Guess an Integer |  |  |                  |      |      |        |               |            |       |          |             |   |                       |       |                 |

Number in a Range, Factorial of a given number.

| <b>Unit - II</b>   | <b>C PROGRAMMING</b>  | Periods | <b>9</b>  |
|--|---|---------|-----------|
| Introduction to C – Features - Data Types – Constants – Variables - I/O Statement - Operators –Expressions - Decision Making and Branching – Looping Statements - Break, Goto, Continue.   |   |         |           |
| <b>Unit – III</b>  | <b>ARRAYS AND POINTERS</b>  | Periods | <b>9</b>  |
| Arrays: Concepts – Need – one dimensional array – array declaration – features – array initialization - Two-Dimensional Arrays- Multidimensional Arrays.<br>Pointers: Introduction, pointer declaration-accessing variable through pointer-pointers and Arrays, Pointers and strings – Pointers structures-pointer Arithmetic - Array of Pointers – dynamic memory allocation. |   |         |           |
| <b>Unit - IV</b>   | <b>FUNCTIONS AND STRINGS</b>  | Periods | <b>9</b>  |
| Function: Introduction, function declaration, defining and accessing functions, User-defined Functions-storage classes-function prototypes-parameter passing methods-recursion.<br>Strings: Concepts – Strings manipulation - String Input / Output Functions- Strings standard functions - Arrays of Strings.   |   |         |           |
| <b>Unit – V</b>  | <b>STRUCTURES AND UNIONS</b>  | Periods | <b>9</b>  |
| Structures-Introduction- nested structures- Arrays of Structures - Structures and Functions - Pointers to Structures – Unions- Type Definition – Bitfields- Enumerated Types.  |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
| 1.   | Kernighan BW and Ritchie DM, “The C Programming Language”, 2nd Edition, Prentice Hall of India, 2015.                                   |         |           |
| 2.   | E. Balagurusamy, Computer Programming, First Edition, Mc Graw Hill, 2016.   |         |           |
| <b>References</b>  |   |         |           |
| 1.   | Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition   |         |           |
| 2.   | Dr.V.Rameshbabu, Dr.R.Samyutha, M.Muni Rathnan, “Computer Programming”, VRB Publishers Pvt.Ltd,   |         |           |
| 3.   | E. Balagurusamy, Programming in ANSI C, Seventh Edition, Mc Graw Hill, 2017.  |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1.   | <a href="https://www.geeksforgeeks.org/c-language-set-1-introduction/">https://www.geeksforgeeks.org/c-language-set-1-introduction/</a> |         |           |
| 2.   | <a href="https://www.programiz.com/c-programming">https://www.programiz.com/c-programming</a>   |         |           |
| 3.   | <a href="https://www.cprogramming.com/">https://www.cprogramming.com/</a>   |         |           |

|  |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
|--|---|------|------|----------------|------|------|-----------------|------|------|------------|---|-------------|-----------------------|-------|---------------|-----------------|--|--|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |      |      |                |      |      |                 |      |      |            |  |             |                       |       |               |                 |  |  |
| Programme  | <b>B.E.</b>   |      |      | Programme Code |      |      | <b>102</b>      |      |      | Regulation |   | <b>2019</b> |                       |       |               |                 |  |  |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>   |      |      |                |      |      |                 |      |      |            | Semester  |             | <b>I</b>              |       |               |                 |  |  |
| Course Code  | Course Name   |      |      |                |      |      | Periods Perweek |      |      |            |   |             | Credit                |       | Maximum Marks |                 |  |  |
|  |   |      |      |                |      |      | L               | T    | P    | C          | CA  | ESE         | Total                 |       |               |                 |  |  |
| <b>U19GE101</b>  | <b>Engineering Graphics *</b>   |      |      |                |      |      | 2               | 0    | 3    | 3          | 60  | 40          | 100                   |       |               |                 |  |  |
| <b>Course Objective</b>  | The students should made to   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
|  | <ul style="list-style-type: none"> <li>Develop skills to enhance their ability to know the concept of engineering graphics and to draw the points kept in various positions, lines and planes.</li> <li>Project the drawing of various solids.</li> <li>Sketch sectioned views of solids.</li> <li>Draw the development of surfaces.</li> <li>Draw the isometric and orthographic projections for any given object to the required standard.</li> </ul> |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
|  | At the end of the course, the student should be able to   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               | Knowledge Level |  |  |
|  | <b>CO1:</b> Construct plane curves and develop projection of points , lines and plane surfaces  |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               | K2              |  |  |
|  | <b>CO2:</b> Construct projection of solids with various conditions.   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               | K4              |  |  |
| <b>CO3:</b> Design the section of solids and analyze the true shape of the section                 |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       | K3            |                 |  |  |
| <b>CO4:</b> Design and develop the different solid surfaces.                                       |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       | K2            |                 |  |  |
| <b>CO5:</b> Construct isometric and orthographic projection of different solids.                   |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       | K1            |                 |  |  |
| <b>Pre -requisites</b>   | Nil   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |   |      |      |                |      |      |                 |      |      |            |   |             | <b>CO/PSO Mapping</b> |       |               |                 |  |  |
| COs  | Programme Outcomes (POs)  |      |      |                |      |      |                 |      |      |            |   |             | PSOs                  |       |               |                 |  |  |
|  | PO 1  | PO 2 | PO 3 | PO 4           | PO 5 | PO 6 | PO 7            | PO 8 | PO 9 | PO 10      | PO 11   | PO 12       | PSO 1                 | PSO 2 | PSO 3         | PSO 4           |  |  |
| CO 1   | 3   | 3    | 3    | 3              | 3    |      |                 |      |      |            |   |             | 3                     | 2     |               |                 |  |  |
| CO 2   | 3   | 3    | 2    | 2              | 2    |      |                 |      |      |            |   |             | 2                     | -     |               |                 |  |  |
| CO 3   | 3   | 2    | 2    | 2              | 3    |      |                 |      |      |            |   |             | 2                     | 2     |               |                 |  |  |
| CO 4   | 3   | 2    | 3    | 3              | 2    |      |                 |      |      |            |   |             | 3                     | 2     |               |                 |  |  |
| CO 5   | 3   | 3    | 2    | 3              | 3    |      |                 |      |      |            |   |             | 2                     | 2     |               |                 |  |  |
| <b>Course Assessment Methods</b>   |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| <b>Direct</b>  |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| 1. Continuous Assessment Test I, II &III   |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| 2. Assignment  |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| 3. End-Semester examination  |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| <b>Indirect</b>  |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |
| 1. Course – end survey   |   |      |      |                |      |      |                 |      |      |            |   |             |                       |       |               |                 |  |  |



| <b>Content of the Syllabus</b>   |  |                |             |
|--|--|----------------|-------------|
| <b>Concepts &amp; Conventions (Not for Examination)</b>  | Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. | <b>Periods</b> | <b>1</b>    |
| <b>Unit – I</b>  | <b>PROJECTION OF POINTS, LINES AND PLANESURFACES</b>   | <b>Periods</b> | <b>3+8</b>  |
| Introduction to Plane curves, Orthographic projection – principles – projection of points, straight lines (only first angle projections) and plane surfaces (polygonal and circular).  |  |                |             |
| <b>Unit - II</b>   | <b>PROJECTION OF SOLIDS</b>  | <b>Periods</b> | <b>3+8</b>  |
| Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.  |  |                |             |
| <b>Unit - III</b>  | <b>SECTION OF SOLIDS</b>   | <b>Periods</b> | <b>3+8</b>  |
| Sectioning of solids - prisms, pyramids, cylinder and cone in simple vertical position by cutting plane sinclined to one reference plane and perpendicular to the other - Obtaining true shape of section.   |  |                |             |
| <b>Unit - IV</b>   | <b>DEVELOPMENT OF SURFACES</b>   | <b>Periods</b> | <b>3+8</b>  |
| Development of lateral surfaces of simple solids like prisms, pyramids, cylinders and cones – development of simple truncated solids involving prisms, pyramids, cylinders and cones.  |  |                |             |
| <b>Unit - V</b>  | <b>ISOMETRIC PROJECTIONS, ORTHOGRAPHIC VIEWS FROM PICTORIAL VIEWS</b>  | <b>Periods</b> | <b>5+10</b> |
| <b>Isometric Projection and Introduction to AutoCAD / Solid Edge:</b> Principles of isometric projection - Isometric scale -Isometric projections of simple solids like prisms, pyramids, cylinders and cones & orthographic views from pictorial views. |  |                |             |
| <b>Demonstration only:Computer Aided Drafting (Auto CAD / Solid Edge):</b> Introduction to drafting packages and demonstration of their use.   |  |                |             |
| <b>Total Periods</b>   |  |                | <b>60</b>   |
| <b>Text Book:</b>  |  |                |             |
| 1.   | Basant Agrawal and C.M Agrawal ,“Engineering Drawing ”,Tata McGraw Hill ,Third Edition,2019  |                |             |
| 2  | Jain and Gautam ,“Engineering Graphics & Design ”,Khanna Publishing House, 2018  |                |             |
| <b>Reference Book :</b>  |  |                |             |
| 1.   | Dr.P.Kannan and Dr.J.Bensam Raj, “Engineering Graphics”, JBR Tri Sea Publishers Pvt. Ltd,2018.   |                |             |
| 2.   | K.V Natarajan, "Engineering Drawing and Graphics", M/s. N.Dhanalakshmi, Chennai,2014.  |                |             |
| 3.   | K.Venugopal and V. Prabhu Raja, “Engineering Graphics”New Age International Publishers,2011.   |                |             |
| 4.   | N.S Parthasarathy and Velamurali, “ Engineering Graphics”, Oxford University, New Delhi,2015   |                |             |
| 5.   | Bhatt N.D and Panchal V.M, “Engineering Drawing”, Charotar Publishing House,50 <sup>th</sup> Edition,2010  |                |             |
| <b>E-Resources:</b>  |  |                |             |
| 1.   | <a href="http://nptel.ac.in/courses/105104148">http://nptel.ac.in/courses/105104148</a> , “Engineering Graphics” - Dr. Nihar Ranjan Patra , IIT Kanpur   |                |             |
| 2.   | <a href="http://cfd.annauniv.edu/webcontent.htm">http://cfd.annauniv.edu/webcontent.htm</a> , “Engineering Graphics” - Dr.Velamurali   |                |             |
| 3.   | <a href="http://link.springer.com/">http://link.springer.com/</a> “Engineering Graphics”-Springer Nature.  |                |             |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(Autonomous Institution, Affiliated to Anna University, Chennai)  
Elayampalayam, Tiruchengode – 637 205



| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |     |
|---|--|------------------|------------|------------|-------------|---------------|-----------------|-----|
| Department  | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |                  |            | Semester   | <b>I</b>    |               |                 |     |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                 |     |
|   |  | L                | T          | P          |             | C             | CA              | ESE |
| <b>U19CH106</b>   | <b>CHEMISTRY LABORATORY</b>  | 0                | 0          | 4          | 2           | 60            | 40              | 100 |
| <b>Course Objective</b>   | <p>The students should made to</p> <ul style="list-style-type: none"> <li>• Gather basic simple acid-base reactions and study the mechanism of acid mixture with base.</li> <li>• Learn pH and potential of hydrogen in a sample solution.</li> <li>• Study the redox reaction through potential difference.</li> <li>• Quote iron forms complex with thiocyanate.</li> <li>• Gather knowledge on hardness producing salts and removal of hardness through estimation.</li> <li>• Collect data required for dissolved oxygen present in water sample.</li> <li>• Understand alkalinity and available chlorine present in water sample</li> </ul> |                  |            |            |             |               |                 |     |
| <b>Course Outcomes</b>  | At the end of the course, the student should be able to  |                  |            |            |             |               | Knowledge Level |     |
|   | <b>CO1:</b> Infer knowledge on neutralization reaction between acid, acid mixture with base and identify the concentrations.   |                  |            |            |             |               | K3              |     |
|   | <b>CO2:</b> Spot the concentration of sample solution through potential of hydrogen and redox reaction.  |                  |            |            |             |               | K3              |     |
|   | <b>CO3:</b> Estimate Iron by complexation reaction spectrometrically.  |                  |            |            |             |               | K5              |     |
|   | <b>CO4:</b> Determine hardness and dissolved oxygen present in domestic water supply.  |                  |            |            |             |               | K5              |     |
| <b>CO5:</b> Identify alkalinity and available chlorine present in the given sample. |  |                  |            |            |             | K5            |                 |     |
| <b>Pre-requisites</b>   | Nil  |                  |            |            |             |               |                 |     |



| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1                  | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3                        | 3    |      | 2    | 2    | 1    | 1    |      |      |       |       | 2     | 2                     | 2     |       |       |
| CO 2   | 3                        | 3    |      | 2    | 1    |      |      |      |      |       |       | 1     | 2                     | 2     |       |       |
| CO 3   | 3                        | 3    |      | 2    | 1    |      |      |      |      |       |       |       | 1                     | 1     |       |       |
| CO 4   | 3                        | 3    | 1    | 2    | 2    | 2    | 2    |      |      |       |       | 2     | 2                     | 2     |       |       |
| CO 5   | 2                        | 3    | 1    | 2    | 2    | 2    | 2    |      |      |       |       | 2     | 1                     | 1     |       |       |

**LIST OF EXPERIMENTS**

|  |           |
|--|-----------|
| 1. Estimation of HCL using NaOH by Conductometric titration                                      | CO1       |
| 2. Estimation of Mixture of acid using NaOH by Conductometric titration.                         | CO1       |
| 3. Estimation of Barium chloride using sodium sulphate by Conductometric precipitation titration | CO1       |
| 4. Estimation of ferrous iron by Potentiometric titration.                                       | CO2       |
| 5. Determination of HCL using NaOH by pH metry   | CO1       |
| 6. Estimation of Ferric ion by Spectrophotometry   | CO3       |
| 7. Determination of Total, temporary and permanent hardness of water by EDTA method.             | CO4       |
| 8. Estimation of Dissolved Oxygen content in water by Winkler's method                           | CO4       |
| 9. Estimation of alkalinity in water sample.   | CO5       |
| 10. Estimation of available chlorine in bleaching powder.  | CO5       |
| <b>Total Periods</b>   | <b>45</b> |

**Lab Manuals suggested:**

|    |   |
|----|---|
| 1. | Chemistry laboratory I & II by Dr.A.Ravikrishnan,Sri Krishna Pub,Revised Edition-2017 |
| 2. | Chemistry laboratory Manual by Dr.Veeraiyan, Revised Edition-2017                     |



|  |   |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |
|--|---|-------------|-------------|---------------------------|-------------|-------------|------------------|-------------|-------------|--------------|---|-----------------|-----------------------|--------------|--------------|--------------|
|                                     | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |             |             |                           |             |             |                  |             |             |              |  |                 |                       |              |              |              |
| Programme  | <b>B.E.</b>   |             |             | Programme Code <b>102</b> |             |             | Regulation       |             |             | <b>2019</b>  |   |                 |                       |              |              |              |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>   |             |             |                           |             |             | Semester         |             |             | <b>I</b>     |   |                 |                       |              |              |              |
| Course Code  | Course Name   |             |             |                           |             |             | Periods Per Week |             |             | Credit       | Maximum Marks   |                 |                       |              |              |              |
|  |   |             |             |                           |             |             | L                | T           | P           | C            | CA  | ESE             | Total                 |              |              |              |
| <b>U19CS102</b>  | <b>Computer Practices Laboratory</b>  |             |             |                           |             |             | 0                | 0           | 4           | 2            | 60  | 40              | 100                   |              |              |              |
| <b>Course Objective</b>  | <p>The students should made to</p> <ul style="list-style-type: none"> <li>• Make the students to learn the programming language</li> <li>• Understand the basic programming constructs and articulate how they are used</li> <li>• Develop a program with a desired runtime execution flow</li> <li>• Articulate where computer programs fit in the provision of computer based solutions to real world problems</li> </ul> |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |             |             |                           |             |             |                  |             |             |              |   | Knowledge Level |                       |              |              |              |
|  | <b>CO1:</b> Prepare document using word processor   |             |             |                           |             |             |                  |             |             |              |   | K3              |                       |              |              |              |
|  | <b>CO2:</b> Sketch flow of execution of C programs using algorithm and flowcharts   |             |             |                           |             |             |                  |             |             |              |   | K3              |                       |              |              |              |
|  | <b>CO3:</b> Write the simple C Programs using decision and looping statements   |             |             |                           |             |             |                  |             |             |              |   | K3              |                       |              |              |              |
|  | <b>CO4:</b> Demonstrate code reusability with the help of user defined functions and pointers.  |             |             |                           |             |             |                  |             |             |              |   | K4              |                       |              |              |              |
| <b>CO5:</b> Write programs that perform operations using derived data types.   |   |             |             |                           |             |             |                  |             |             |              | K3  |                 |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak                   |   |             |             |                           |             |             |                  |             |             |              |   |                 | <b>CO/PSO Mapping</b> |              |              |              |
| <b>Cos</b>   | Programme Outcomes (POs)  |             |             |                           |             |             |                  |             |             |              |   |                 | PSOs                  |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b>               | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b>      | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b>  | <b>PO 12</b>    | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 3           | 3           | 1                         |             |             |                  | 3           | 3           | 3            | 3   | 3               | 3                     | 1            |              |              |
| <b>CO 2</b>  | 3   | 3           | 3           | 1                         |             |             |                  | 3           | 3           | 3            | 3   | 3               | 3                     | 1            |              |              |
| <b>CO 3</b>  | 3   | 3           | 3           | 1                         |             |             |                  | 3           | 3           | 3            | 3   | 3               | 3                     | 1            |              |              |
| <b>CO 4</b>  | 3   | 3           | 3           | 3                         |             |             |                  | 3           | 3           | 3            | 3   | 3               | 3                     | 1            |              |              |
| <b>CO 5</b>  | 3   | 3           | 3           | 3                         |             |             |                  | 3           | 3           | 3            | 3   | 3               | 3                     | 1            |              |              |
| <b>Course Assessment Methods</b>   |   |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |
| <b>Direct</b>  |   |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |
| <ol style="list-style-type: none"> <li>1. Pre lab and post lab test</li> <li>2. End-Semester examinations</li> </ol> |   |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |
| <b>Indirect</b>  |   |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |
| <ol style="list-style-type: none"> <li>1. Course –end survey</li> </ol>  |   |             |             |                           |             |             |                  |             |             |              |   |                 |                       |              |              |              |

### SUGGESTED LIST OF EXPERIMENTS

|   | Course Outcome                             |                |       |  |       |                  |         |   |         |  |     |
|---|--|----------------|-------|--|-------|------------------|---------|---|---------|--|-----|
| <p>1. Design an algorithm and flowchart using word processor that reads the customer number and power consumed and prints the amount to be paid by the customer. An electric power distribution company charges its domestic consumers as follows</p> <table style="margin-left: 40px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Consumption Units</th> <th style="text-align: center;">Rate of Charge</th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;">-----</td> </tr> <tr> <td style="text-align: center;">0-200</td> <td style="text-align: center;">Rs.0.50 per unit</td> </tr> <tr> <td style="text-align: center;">201-400</td> <td style="text-align: center;">Rs.100 plus Rs.0.65 per unit excess 200</td> </tr> <tr> <td style="text-align: center;">401-600</td> <td style="text-align: center;">Rs.230 plus Rs.0.80 per unit excess of 400</td> </tr> </tbody> </table> | Consumption Units                          | Rate of Charge | ----- |  | 0-200 | Rs.0.50 per unit | 201-400 | Rs.100 plus Rs.0.65 per unit excess 200 | 401-600 | Rs.230 plus Rs.0.80 per unit excess of 400 | CO1 |
| Consumption Units   | Rate of Charge                             |                |       |  |       |                  |         |   |         |  |     |
| -----   |  |                |       |  |       |                  |         |   |         |  |     |
| 0-200   | Rs.0.50 per unit                           |                |       |  |       |                  |         |   |         |  |     |
| 201-400   | Rs.100 plus Rs.0.65 per unit excess 200    |                |       |  |       |                  |         |   |         |  |     |
| 401-600   | Rs.230 plus Rs.0.80 per unit excess of 400 |                |       |  |       |                  |         |   |         |  |     |
| <p>2. Design an algorithm and flowchart for a simple calculator program using word processor for performing various arithmetic operations such as</p> <p style="margin-left: 40px;">“+”     -Addition<br/> “_”     - Subtraction<br/> “*”     - Multiplication<br/> “/”     - Division<br/> “%”     - Modulus</p>   | CO2  |                |       |  |       |                  |         |   |         |  |     |
| <p>3. Design and develop a C program to accept a number from the user and check whether it is a Palindrome or not.</p> <p style="margin-left: 40px;">Palindromenumber:(a number is a Palindrome which when read in reverse order is same as read in the right order)<br/> Example: Palindrome<br/> :11,                 101,<br/> 151 Not a Palindrome: 1<br/> 23,100</p>   | CO3  |                |       |  |       |                  |         |   |         |  |     |
| <p>4. Develop a C program to find the sum of the digits of an integer and the number of digits in the integer that is given as input by the user.</p> <p style="margin-left: 40px;">Test Case:<br/> Sample Input<br/> :15390 Sample Output:<br/> Sum of the digits=18<br/> No. of digits =5</p> <p style="margin-left: 40px;">For an incorrect choice, an appropriate error message should be displayed.</p>  | CO3  |                |       |  |       |                  |         |   |         |  |     |
| <p>5. Develop a program to perform the following operations using two dimensional or multi-dimensional matrices:</p> <ol style="list-style-type: none"> <li>a. Addition of two matrices(3x3)</li> <li>b. Subtraction of two matrices(2x2)</li> <li>c. Multiplication of two matrices using dynamic memory allocation.</li> </ol>  | CO3  |                |       |  |       |                  |         |   |         |  |     |
| <p>6. Write a program to find the maximum and minimum element in a set of inputs using one dimensional array.</p>   | CO3  |                |       |  |       |                  |         |   |         |  |     |
| <p>7. Write a program to count the total number of vowels and consonants in a string. For example Input string:I am proud to be an Indian<br/> Output: Total vowels-10 and Total consonants-10</p>  | CO4  |                |       |  |       |                  |         |   |         |  |     |

**Signature of the BOS chairman, EEE**

|  |   |           |
|--|---|-----------|
| <p>8. Develop a program to perform the following string manipulations without using string functions:</p> <ul style="list-style-type: none"> <li>d. String copy</li> <li>e. String Concatenate</li> <li>f. String length</li> <li>g. String Compare</li> </ul> <p>9. The Fibonacci numbers are defined recursively as follows: <math>F_1=1</math><br/> <math>F_2=1</math><br/> <math>F_n=F_{n-1}+F_{n-2}, n&gt;2</math><br/> Write a function that will generate and print the first n Fibonacci numbers. Test the function for n=5,10,15</p> <p>10. Write a function using pointers to exchange the values to reside in two locations in the memory. Test Case:<br/> Input: A=10, B=-5<br/> Output: A=-5, B=10</p> <p>11. Develop a program to build a database of students with the following attributes: Roll no, Name, Course, Stream, Percentage, and Division. Take input for each student in all fields except division. Calculate division of each student such that those students having percentage <math>\geq 60\%</math> belong to first division. Similarly, for second and third division students having conditions <math>50\% \leq \text{percentage} &lt; 60\%</math> and <math>35\% \leq \text{percentage} &lt; 50\%</math> respectively. If any student has percentage less than 35% then write "fail" in division field. After building the database display the database of the students. Hint: create database using structure.</p> | <p>CO4</p> <p>CO4</p> <p>CO4</p> <p>CO5</p>   |           |
| <b>Total Periods</b>   |   | <b>45</b> |
| <b>E-Resources</b>   |   |           |
| 1.   | <a href="https://www.programiz.com/c-programming">https://www.programiz.com/c-programming</a>                           |           |
| 2.   | <a href="https://www.cprogramming.com/">https://www.cprogramming.com/</a>   |           |
| 3.   | <a href="https://beginnersbook.com/2015/02/simple-c-programs/">https://beginnersbook.com/2015/02/simple-c-programs/</a> |           |

|   |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
|---|---|-----------------|------------------|------|------|--------|---------------|------------|-----------------|-----------|--|----------------|-----------------------|-----------|-------|-------|
|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| Programme   | <b>B.E.</b>   | Programme Code  |                  |      |      |        |               | <b>102</b> | Regulation      |           |  | <b>2019</b>    |                       |           |       |       |
| Department  | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>   |                 |                  |      |      |        | Semester      |            |                 | <b>II</b> |  |                |                       |           |       |       |
| Course Code   | Course Name   |                 | Periods Per Week |      |      | Credit | Maximum Marks |            |                 |           |  |                |                       |           |       |       |
|   |   |                 | L                | T    | P    | C      | CA            | ESE        | Total           |           |  |                |                       |           |       |       |
| <b>U19MA202</b>   | <b>Linear Algebra and Ordinary Differential Equations *</b>   |                 | 3                | 1    | 0    | 4      | 40            | 60         | 100             |           |  |                |                       |           |       |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>Understand Eigen values and Eigen vectors and its role in the system of equations.</li> <li>Proficiently understand the vector differential calculus.</li> <li>Demonstrate vector integral calculus.</li> <li>Know about Cartesian and Polar co-ordinates and also transformations.</li> <li>Identify the Laplace transform of derivatives and integrals.</li> </ul> |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                 |                  |      |      |        |               |            | Knowledge level |           |  |                |                       |           |       |       |
|   | <b>CO1:</b> Analyze the Reduction of a quadratic form.  |                 |                  |      |      |        |               |            | K3, K4          |           |  |                |                       |           |       |       |
|   | <b>CO2:</b> Identify vector differential calculus.  |                 |                  |      |      |        |               |            | K2, K3          |           |  |                |                       |           |       |       |
|   | <b>CO3:</b> Apply Green's , Stoke's and Gauss Divergence theorems   |                 |                  |      |      |        |               |            | K1, K5          |           |  |                |                       |           |       |       |
|   | <b>CO4:</b> Identifying the analytic functions  |                 |                  |      |      |        |               |            | K2, K5          |           |  |                |                       |           |       |       |
| <b>CO5:</b> Recognize the Laplace transform of unit step and unit impulse functions.  |   |                 |                  |      |      |        |               | K5, K3     |                 |           |  |                |                       |           |       |       |
| <b>Pre-requisites</b>   | -   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |   |                 |                  |      |      |        |               |            |                 |           |  |                | <b>CO/PSO Mapping</b> |           |       |       |
| <b>COs</b>  | Programme Outcomes (POs)  |                 |                  |      |      |        |               |            |                 |           |  |                | PSOs                  |           |       |       |
|   | PO 1  | PO 2            | PO 3             | PO 4 | PO 5 | PO 6   | PO 7          | PO 8       | PO 9            | PO 10     | PO 11  | PO 12          | PSO 1                 | PSO 2     | PSO 3 | PSO 4 |
| CO 1  | 3   | 3               |                  |      |      |        |               |            |                 |           |  |                | 2                     |           |       |       |
| CO 2  | 3   | 3               |                  |      |      |        |               |            |                 |           |  |                | 2                     |           |       |       |
| CO 3  | 3   | 3               |                  |      |      |        |               |            |                 |           |  |                | 2                     |           |       |       |
| CO 4  | 3   | 3               |                  |      |      |        |               |            |                 |           |  |                | 2                     |           |       |       |
| CO 5  | 3   | 3               |                  |      |      |        |               |            |                 |           |  |                | 2                     |           |       |       |
| <b>Course Assessment Methods</b>  |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| <b>Direct</b>   |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| 1. Continuous Assessment Test I, II &III  |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| 2. Assignment.  |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| 3. End-Semester examinations  |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| <b>Indirect</b>   |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| 1. Course – end survey  |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| <b>Content of the Syllabus</b>  |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |
| <b>Unit – I</b>   |   | <b>MATRICES</b> |                  |      |      |        |               |            |                 |           |  | <b>Periods</b> |                       | <b>12</b> |       |       |
| Characteristic equation – Eigen values and Eigenvectors of a real matrix– Properties of Eigen values and eigenvectors – Cayley-Hamilton theorem(excluding proof) – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms. Simple application in encoding message using 2×2 matrix. |   |                 |                  |      |      |        |               |            |                 |           |  |                |                       |           |       |       |

| <b>Unit - II</b>  | <b>VECTOR DIFFERENTIAL CALCULUS</b>   | <b>Periods</b> | <b>12</b> |
|---|---|----------------|-----------|
| Vector Differentiation: Vector and Scalar Functions- Derivatives- Curves, Gradient of a Scalar Field-Directional Derivative -Divergence of a Vector Field - Curl of a Vector Field – Tangents and Normals   |   |                |           |
| <b>Unit – III</b>   | <b>VECTOR INTEGRAL CALCULUS</b>   | <b>Periods</b> | <b>12</b> |
| Line, Surface and Volume integrals, Green’s theorem in a plane(excluding proof), Gauss Divergence theorem(excluding proof), Stokes theorem (Excluding proof) - simple applications involving rectangular parallelepipeds and spheres.   |   |                |           |
| <b>Unit - IV</b>  | <b>ANALYTIC FUNCTIONS</b>   | <b>Periods</b> | <b>12</b> |
| Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $c+z$ , $cz$ , $1/z$ and Bilinear transformation.   |   |                |           |
| <b>Unit – V</b>   | <b>LAPLACE TRANSFORMS</b>   | <b>Periods</b> | <b>12</b> |
| Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems(excluding proof) -Transforms of derivatives and integrals – Initial and final value theorems(excluding proof) – Inverse transforms – Convolution theorem(excluding proof) – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients. |   |                |           |
| <b>Total Periods</b>  |   |                | <b>60</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | T.Veerarajan, Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd-2012   |                |           |
| 2.  | Ravish R Sing , Mukul Bhatt, “Engineering Mathematics”, Mc Graw Hill Education Pvt. Ltd-2018  |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics” , Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.                      |                |           |
| 2.  | Kreyszig, E., Advanced Engineering Mathematics (10th Edition), John Wiley (2015).   |                |           |
| 3.  | Alan Jefferis , Advanced Engineering Mathematics, Academic Press- New Delhi-2003  |                |           |
| 4.  | Yunus A.Cengel, William J.Palm III,” Differential equations for Engineers & Scientists”, Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012. |                |           |
| 5.  | John Bird, Higher Engineering Mathematics, Anuradha Agencies(2004)  |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://en.wikipedia.org/wiki/Ordinary_differential_equation">https://en.wikipedia.org/wiki/Ordinary_differential_equation</a>                     |                |           |
| 2.  | <a href="http://www.learnerstv.com/Free-engineering-Video-lectures">www.learnerstv.com/Free-engineering-Video-lectures</a>                                  |                |           |
| 3.  | <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>  |                |           |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**

(Autonomous Institution, Affiliated to Anna University, Chennai)

Elayampalayam, Tiruchengode – 637 205




|                         |  |                  |     |            |        |               |     |                 |  |
|-------------------------|--|------------------|-----|------------|--------|---------------|-----|-----------------|--|
| Programme               | <b>B.E.</b>  | Programme code   | 102 | Regulation | 2019   |               |     |                 |  |
| Department              | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |                  |     | Semester   | II     |               |     |                 |  |
| Course code             | Course name  | Periods per week |     |            | Credit | Maximum Marks |     |                 |  |
|                         |  | L                | T   | P          | C      | CA            | ESE | Total           |  |
| <b>U19EN202</b>         | <b>English for Communication - II</b>  | 3                | 0   | 0          | 3      | 40            | 60  | 100             |  |
| <b>Course Objective</b> | The students should be made to   |                  |     |            |        |               |     |                 |  |
|                         | <ul style="list-style-type: none"> <li>• Provide suitable listening tasks to develop communicative ability for academic and professional progress</li> <li>• Inculcate channelized reading to make learners proficient in the chosen professional writing contexts.</li> <li>• Improve learners' vocabulary and grammar to supplement their language use at professional contexts</li> <li>• Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning. Identify and begin to apply the language features of academic and professional writing and speaking</li> </ul> |                  |     |            |        |               |     |                 |  |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |     |            |        |               |     | Knowledge Level |  |
|                         | <b>CO1:</b> Acquire sufficient command over language to speak at an academic or professional context through continuous exposure to similar listening tasks.   |                  |     |            |        |               |     | K2              |  |
|                         | <b>CO2:</b> Write technically well at a professional contexts through exposing them to similar readings.   |                  |     |            |        |               |     | K3              |  |
|                         | <b>CO3:</b> Use language at length at technical and professional situations through the enrichment of vocabulary and strengthening of grammatical knowledge.   |                  |     |            |        |               |     | K3              |  |
|                         | <b>CO4:</b> Students should be able to ethically gather, understand, evaluate and synthesize information from a variety of written and electronic sources.   |                  |     |            |        |               |     | K2              |  |
| <b>Pre-requisites</b>   | Nil  |                  |     |            |        |               |     |                 |  |



| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |       |  |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|-------|--|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |       |  |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |  |
| CO 1  |                          |      |      |      |      | 2    |      |      | 3    | 3     |       | 3     | 3              |       |       |       |  |
| CO 2  |                          |      |      |      |      | 2    |      |      | 3    | 3     |       | 3     | 3              |       |       |       |  |
| CO 3  |                          |      |      |      |      | 2    |      |      | 3    | 3     |       | 3     | 3              |       |       |       |  |
| CO 4  |                          |      |      |      |      | 2    |      |      | 3    | 3     |       | 3     | 3              |       |       |       |  |
| CO 5  |                          |      |      |      |      | 2    |      |      | 3    | 3     |       | 3     | 3              |       |       |       |  |

|                                  |   |
|----------------------------------|---|
| <b>Course Assessment Methods</b> |   |
| <b>Direct</b>                    | <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp; III</li> <li>2. Assignment: Simulation using tool</li> <li>3. End-Semester examinations</li> </ol> |
| <b>Indirect</b>                  | 1. Course – end survey  |

| Content of the syllabus  |   |                |                      |
|--|---|----------------|----------------------|
| <b>Unit - I</b>  |   | <b>Periods</b> | <b>9</b>             |
| <b>Listening-</b> Listening for Cultural Awareness, Listening to Professional Conversations, Talks, Interviews and Lectures<br><b>Speaking-</b> Developing Confidence to get rid of Fear on the Dias, Discussion at a Corporate Context. <b>Reading-</b> Inferential Reading, Reading Short Messages and Technical Articles, <b>Writing-</b> Introduction to Letter Writing, Writing Formal and Informal Letters, Thanking Letters, Letters Calling for Quotations, Letters Placing an Order, Seeking clarification, Letters of Complaint. <b>Focus on Language-</b> Adjectives and Degrees of Comparisons |   |                |                      |
| <b>Unit - II</b>   |   | <b>Periods</b> | <b>9</b>             |
| <b>Listening-</b> Listening to specific information relating to technical content, Listening for statistical information <b>Speaking-</b> Expressing opinions, Formal Discussions, Describing Role Play at Business Context and Consolidating Ideas. <b>Reading-</b> Reading Technical Articles in Journals and Comparing Articles. <b>Writing-</b> Letter seeking permission to undergo practical training and to undertake project work. <b>Focus on Language-</b> Simple, compound and complex sentences and Transformation of Sentences.   |   |                |                      |
| <b>Unit - III</b>  |   | <b>Periods</b> | <b>9</b>             |
| <b>Listening-</b> Listening to understand the overall meaning, Listening to Interviews and Presentations. <b>Speaking-</b> Giving Instructions and Showing Directions and Rephrasing Instructions. <b>Reading-</b> Skimming and Scanning, Reading Job Advertisements. <b>Writing-</b> Applying for a Job, Writing a CV. <b>Focus on Language-</b> Pronouns, Phrasal verbs, Restrictive and Non - restrictive clauses.  |   |                |                      |
| <b>Unit - IV</b>   |   | <b>Periods</b> | <b>9</b>             |
| <b>Listening-</b> Listening and retrieving Information. <b>Speaking-</b> Developing fluency and Coherence, Accent Neutralization, Voice Modulation, and Intonation, Improving Voice Quality. <b>Reading-</b> Reading and understanding Advertisements. <b>Writing-</b> Letters to the Editor, Letter of Complaint, Various kinds of Reports, Permission to go for Industrial visits. <b>Focus on Language-</b> Countable, Uncountable nouns, Recommendations, Discourse Markers and Comparative and Contrastive Connectives, Imperatives.  |   |                |                      |
| <b>Unit - V</b>  |   | <b>Periods</b> | <b>9</b>             |
| <b>Listening-</b> Listening to Fragmented Texts and Filling in the Blanks. <b>Speaking-</b> Mind Mapping, Developing Coherence and Self-Expression, Making presentations, Paralinguistic and Extra linguistic Features (body language), <b>Reading-</b> Predicting content, Interpreting Reports. <b>Writing-</b> Writing Proposals, Agenda, Minutes of the Meeting. <b>Focus on Language-</b> British and American Vocabulary, Editing, Error Detection, and Punctuation.   |   |                |                      |
|  |   |                | <b>Total Periods</b> |
|  |   |                | <b>45</b>            |
| <b>Text books</b>  |   |                |                      |
| 1.   | Sumant.S,Pereira Joyce, English for Communication, Vijay Nicole Imprints Pvt.Ltd., 2014.  |                |                      |
| 2.   | Sokkaalingam, S.RM., The Art Of Speaking English Versatile Publishing House, 2018.  |                |                      |
| <b>Reference books</b>   |   |                |                      |
| 1.   | Norman Whitby - Business Benchmark Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2008. , 1997.   |                |                      |
| 2.   | Dutt, Rajeevan, Prakash .A Course in Communication Skills (Anna University, Coimbatore edition) :. Cambridge University Press India Pvt.Ltd, 2007.                            |                |                      |
| 3.   | Meenakshi Raman and Sangeeta Sharma-"Technical Communication English Skills for Engineers"; Oxford University Press, 2008.  |                |                      |
| 4.   | S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering, Orient Blackswan Pvt, Ltd, 2009.   |                |                      |
| 5.   | Technical English – I & II, Sonaversity, Sona College of Technology, Salem, First Edition, 2012.  |                |                      |
| <b>E-Resources</b>   |   |                |                      |
| 1  | <a href="http://www.kalevleetar.com/Publish/Book_Review_Who_Moved_My_Cheese.pdf">http://www.kalevleetar.com/Publish/Book_Review_Who_Moved_My_Cheese.pdf</a>                   |                |                      |
| 2  | <a href="http://www.bookbrowse.com/reviews/index.cfm/book_number/304/who-moved-my-cheese">http://www.bookbrowse.com/reviews/index.cfm/book_number/304/who-moved-my-cheese</a> |                |                      |
| 3  | <a href="http://www.imdb.com/title/tt0482629/plotsummary">http://www.imdb.com/title/tt0482629/plotsummary</a>   |                |                      |

|  |  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
|--|--|------------------|------|------|--------|------|---------------|------------|------------|-------|---|-----------------|-----------------------|-------|-------|-------|
|                    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |      |      |        |      |               |            |            |       |  |                 |                       |       |       |       |
| Programme  | <b>B.E.</b>  | Programme Code   |      |      |        |      |               | <b>102</b> | Regulation |       | <b>2019</b>   |                 |                       |       |       |       |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |                  |      |      |        |      | Semester      |            | <b>II</b>  |       |   |                 |                       |       |       |       |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit |      | Maximum Marks |            |            |       |   |                 |                       |       |       |       |
|  |  | L                | T    | P    | C      |      | CA            | ESE        | Total      |       |   |                 |                       |       |       |       |
| <b>U19PH207</b>  | <b>ENGINEERING PHYSICS<sup>s</sup></b>   | 3                | 0    | 0    | 3      |      | 40            | 60         | 100        |       |   |                 |                       |       |       |       |
| <b>Course Objective</b>  | The student should be made to,   |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
|  | <ul style="list-style-type: none"> <li>• Understand the basic concepts of properties of matter</li> <li>• Gain knowledge about the conduction properties of metals</li> <li>• Identify the different types of crystal structures and crystal growth techniques. Study the production and applications of ultrasonics.</li> <li>• Correlate better understanding the carrier concentration and its variations with temperature in a semiconductor. Study the properties of modern engineering materials and its uses</li> <li>• Categorize the types of laser and fiber optics</li> </ul> |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student will be able to  |                  |      |      |        |      |               |            |            |       |   | Knowledge Level |                       |       |       |       |
|  | <b>CO1:</b> Understand the elastic properties of the materials   |                  |      |      |        |      |               |            |            |       |   | K2              |                       |       |       |       |
|  | <b>CO2:</b> Gain knowledge about the conduction properties of metals   |                  |      |      |        |      |               |            |            |       |   | K3              |                       |       |       |       |
|  | <b>CO3:</b> Determine packing factor for various unit cells and understand different types of crystal imperfections and learn the engineering, medical applications.   |                  |      |      |        |      |               |            |            |       |   | K1              |                       |       |       |       |
|  | <b>CO4:</b> Discuss the basic idea of semiconducting materials and realize the function of modern engineering materials  |                  |      |      |        |      |               |            |            |       |   | K1              |                       |       |       |       |
| <b>CO5:</b> Learn the optical properties of materials and its uses                                 |  |                  |      |      |        |      |               |            |            |       | K3  |                 |                       |       |       |       |
| <b>Pre-requisites</b>  | ---  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                  |      |      |        |      |               |            |            |       |   |                 | <b>CO/PSO Mapping</b> |       |       |       |
| COs  | Programme Outcomes (POs)   |                  |      |      |        |      |               |            |            |       |   |                 | PSOs                  |       |       |       |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5   | PO 6 | PO 7          | PO 8       | PO 9       | PO 10 | PO 11   | PO 12           | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3  | 2                | 3    | 1    | 2      |      |               |            |            |       |   |                 |                       | 2     |       |       |
| CO 2   | 3  | 2                | 3    | 3    | 1      |      |               |            |            |       |   |                 |                       |       |       |       |
| CO 3   | 3  | 3                |      | 3    | 1      |      |               |            |            |       |   |                 |                       | 2     |       |       |
| CO 4   | 3  |                  | 2    | 1    | 1      |      |               |            |            |       |   |                 | 3                     | 2     |       |       |
| CO 5   | 3  |                  |      | 1    | 2      | 2    |               |            |            |       |   |                 |                       | 2     |       |       |
| <b>Course Assessment Methods</b>   |  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
| <b>Direct</b>  |  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
| 1.Continuous Assessment Test I, II & III<br>2.End-Semester examinations                            |  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
| <b>Indirect</b>  |  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |
| 1.Course - end survey  |  |                  |      |      |        |      |               |            |            |       |   |                 |                       |       |       |       |

| <b>Content of the syllabus</b>  |  |                |           |
|---|--|----------------|-----------|
| <b>Unit – I</b>   | <b>PROPERTIES OF MATTER</b>  | <b>Periods</b> | <b>9</b>  |
| <b>Elasticity:</b> Types of moduli of elasticity - Stress - Strain Diagram – uses. Young’s modulus: Experimental determination by non-uniform bending - Twisting couple on a wire – Application: Torsional pendulum.<br><b>Viscosity:</b> Co-efficient of viscosity - Poiseuilles' formula - Experimental determination – uses  |  |                |           |
| <b>Unit - II</b>  | <b>ELECTRONS IN SOLID</b>  | Periods        | 9         |
| Classical theory: Classical free electron theory of metals- Expressions for electrical conductivity and Thermal Conductivity of metals – Wiedemann-Franz law (Qualitative) - Success and failures.<br>Quantum theory: de Broglie’s hypothesis - Schrodinger’s time independent and time dependent wave equations (Qualitative) - Particle in a one-dimensional box - Fermi – Dirac Statistics - Density of energy states (Qualitative).                   |  |                |           |
| <b>Unit – III</b>   | <b>CRYSTAL PHYSICS AND ULTRASONICS</b>   | <b>Periods</b> | <b>9</b>  |
| Crystallography - Unit cell - Crystal systems - Bravais lattices- Lattice planes - Miller indices - Inter-planar spacing in cubic lattice- Calculation of number of atoms per unit cell- Atomic radius – Coordination number- Packing Factor for HCP structures.<br>Ultrasonics: Introduction – Magnetostriction and Piezoelectric Oscillator methods – Applications: Sound Navigation and Ranging (SONAR), Non – Destructive Testing (NDT) and Sonogram. |  |                |           |
| <b>Unit - IV</b>  | <b>SEMICONDUCTING &amp; MODERN ENGINEERING MATERIALS</b>   | <b>Periods</b> | <b>9</b>  |
| Intrinsic semiconductor: (Qualitative only) – Carrier concentration – Fermi level – Electrical conductivity - Band gap determination. Extrinsic semiconductors: Carrier concentration in n – type and p – type semiconductor (Qualitative) – Variation of Fermi level with temperature.<br>Metallic glasses: preparation, properties and applications - Shape memory alloys (SMA): Characteristics and applications of NiTi alloy.                        |  |                |           |
| <b>Unit – V</b>   | <b>LASER AND FIBER OPTICS</b>  | <b>Periods</b> | <b>9</b>  |
| Laser: Characteristics of laser –Derivation of Einstein’s A and B coefficients. Types: Nd-YAG laser - Semiconductor laser: Homo junction - Applications.<br>Optical fiber: Principle of propagation of light through optical fiber - Numerical aperture and acceptance angle (Qualitative) -Types of optical fibers -Fiber optical communication system (block diagram) -Application: Medical endoscope   |  |                |           |
| <b>Total Periods</b>  |  |                | <b>45</b> |
| <b>Text Books</b>   |  |                |           |
| 1.  | R.K. Gaur and Gupta. S.L, Engineering Physics, Dhanpat Rai Publishers, 2017.   |                |           |
| 2.  | S.O Pillai., Solid state physics, New Age International Private Limited.   |                |           |
| 3.  | Dr.P.Mani, “Engineering Physics”, Shri Dhanam publisher, Chennai – 600 042   |                |           |
| <b>References</b>   |  |                |           |
| 1.  | B.K. Pandey, S. Chaturvedi. “Engineering Physics”, 1 <sup>st</sup> Edition, Cengage Learning India Pvt Ltd, 2012.        |                |           |
| 2.  | Fundamentals Of Physics Extended 8/Ed 8th Edition, David Halliday,Robert ResnickJearl Walker, Wiley India Pvt Ltd, 2008. |                |           |
| 3.  | Lawrence H.Vanvlack,“Elements of materials Science Engineering,6 <sup>th</sup> Edition,Pearson Publication.              |                |           |
| 4.  | S.O.Pillai, “Solid State Physics”, New Age International Publishers  |                |           |
| 5.  | Dr.V.Rajendran,“ Engineering Physics”, Tata McGraw Hill Education Private Limited, New Delhi                             |                |           |
| <b>E-Resources</b>  |  |                |           |
| 1.  | <a href="http://www.e-booksdirectory.com">www.e-booksdirectory.com</a>   |                |           |
| 2.  | <a href="http://Home.iitk.ac.in">Home.iitk.ac.in</a>   |                |           |
| 3.  | <a href="http://physics.cu.ac.bd/">physics.cu.ac.bd/</a>   |                |           |

|  |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
|--|--|------------------|------|------|--------|------|---------------|------------|------|----------|--|-----------|-----------------------|-------|-------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| Programme  | <b>B.E.</b>  | Programme Code   |      |      |        |      |               | Regulation |      |          | <b>2019</b>  |           |                       |       |       |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>  |                  |      |      |        |      |               |            |      | Semester |  | <b>II</b> |                       |       |       |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit |      | Maximum Marks |            |      |          |  |           |                       |       |       |
|  |  | L                | T    | P    | C      | CA   | ESE           | Total      |      |          |  |           |                       |       |       |
| <b>U19CS203</b>  | <b>Python Programming</b>  | 2                | 0    | 2    | 3      | 40   | 60            | 100        |      |          |  |           |                       |       |       |
| <b>Course Objective</b>  | The student should be made to,   |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
|  | <ul style="list-style-type: none"> <li>• Understand the fundamentals of Python programming</li> <li>• Handle list, tuples, sets and Dictionaries data types</li> <li>• Learn function prototypes and string functions.</li> <li>• Use files and modules for data processing</li> <li>• Understand packages in Python and data visualization</li> </ul> |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |      |      |        |      |               |            |      |          |  |           | Knowledge Level       |       |       |
|  | <b>CO1:</b> Develop basic Python programs using conditional and control statements   |                  |      |      |        |      |               |            |      |          |  |           | K3                    |       |       |
|  | <b>CO2:</b> Perform operations on list, tuples, sets and Dictionaries.   |                  |      |      |        |      |               |            |      |          |  |           | K3,K4                 |       |       |
|  | <b>CO3:</b> Implement function prototypes and string functions.  |                  |      |      |        |      |               |            |      |          |  |           | K3,K4                 |       |       |
|  | <b>CO4:</b> Apply files and modules and perform operations on CSV files.   |                  |      |      |        |      |               |            |      |          |  |           | K3,K4                 |       |       |
|  | <b>CO5:</b> Perform data visualization and apply Python packages   |                  |      |      |        |      |               |            |      |          |  |           | K3,K4                 |       |       |
| <b>Pre-requisites</b>  | Nil  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak   |  |                  |      |      |        |      |               |            |      |          |  |           | <b>CO/PSO Mapping</b> |       |       |
| <b>Cos</b>   | Programme Outcomes (POs)   |                  |      |      |        |      |               |            |      |          |  |           | PSOs                  |       |       |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5   | PO 6 | PO 7          | PO 8       | PO 9 | PO 10    | PO 11  | PO 12     | PSO 1                 | PSO 2 | PSO 3 |
| CO 1   | 3  | 2                | 1    | -    | -      | 1    | -             | -          | -    | -        | 1  | 1         | 3                     | 2     | -     |
| CO 2   | 3  | 2                | 1    | -    | 2      | 1    | -             | -          | -    | -        | 1  | 1         | 3                     | 2     | -     |
| CO 3   | 3  | 2                | 1    | -    | 2      | 1    | -             | -          | -    | -        | 1  | 1         | 3                     | 2     | -     |
| CO 4   | 3  | 2                | 1    | 1    | 2      | 1    | -             | -          | -    | -        | 1  | 1         | 3                     | 2     | -     |
| CO 5   | 3  | 2                | 1    | -    | 2      | 1    | -             | -          | -    | -        | 1  | 1         | 3                     | 2     | -     |
| <b>Course Assessment Methods</b>   |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>Direct</b>  |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| 1. Continuous Assessment Test I, II & III  |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| 2. Assignment: Implementation of Illustrative programs   |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| 3. End-Semester examinations   |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>Indirect</b>  |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| 1. Course - End survey   |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>Content of the syllabus</b>   |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>Unit – I</b>  | <b>INTRODUCTION TO PYTHON</b>  |                  |      |      |        |      |               |            |      |          | Periods  | <b>12</b> |                       |       |       |
| Introduction to Python, features, installing Python, writing and executing Python program — native data types, comments, constants, variables, operators, expression, conditional statements, control statements, continue, pass, break. |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |
| <b>Illustrative programs:</b> finding factorial of n, generating Fibonacci series, exchange the values of two variables, calculating student grade, sum and average of n elements, linear search, printing a pattern.                    |  |                  |      |      |        |      |               |            |      |          |  |           |                       |       |       |

|  |   |         |           |
|--|---|---------|-----------|
| <b>Unit - II</b>   | <b>LISTS, TUPLES, SETS AND DICTIONARIES</b>   | Periods | <b>12</b> |
| <p>Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Sets: methods and operators, Dictionaries: operations and methods.</p> <p><b>Illustrative programs:</b> find minimum in a list, list operations, create and insert elements in a Dictionary, operations on sets and tuples.</p>  |   |         |           |
| <b>Unit – III</b>  | <b>FUNCTIONS AND STRINGS</b>  | Periods | <b>12</b> |
| <p>Functions definition, declaration, arguments, parameters – formal and local, parameter passing methods - function prototypes, recursion; Strings: string slices, immutability, string functions and methods, string module, regular expressions.</p> <p><b>Illustrative programs:</b> String manipulations, function that takes a list of words and returns the length of the longest one, counting the vowels and consonants in a given string , exchanging of two values using recursion.</p> |   |         |           |
| <b>Unit - IV</b>   | <b>FILES AND MODULES</b>  | Periods | <b>12</b> |
| <p>Files and exception: Text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, accessing CSV file.</p> <p><b>Illustrative programs:</b> Word count, file copy, file operations: accessing a CSV file and generate reports.</p>   |   |         |           |
| <b>Unit – V</b>  | <b>PACKAGES AND DATA VISUALIZATION</b>  | Periods | <b>12</b> |
| <p>Text processing, Numerical processing: numpy package – mean, median and mode, pandas package – vector, data frame, data visualization: matplotlib, Time operations.</p> <p><b>Illustrative programs:</b> Bar chart, Pie Chart, Create and display a data frame from a dictionary input using Pandas, Create a 3x3 matrix with values from 2 to 10 using numpy.</p>  |   |         |           |
| <b>Total Periods</b>   |   |         | <b>60</b> |
| <b>Text Books</b>  |   |         |           |
| 1.   | AnuragGupta,G.P BISWAS ,” Python Programming – Problem solving, packages and Libraries, Edition 1, Tata McGraw Hill, 2018                               |         |           |
| 2.   | E Balagurusamy, “Problem Solving and Python Programming”, Edition 1 , TataMcGraw Hill, 2018   |         |           |
| 3.   | ReemaThareja, “Python Programming using Problem Solving Approach”, OXFORD University Press, 2017.   |         |           |
| <b>References</b>  |   |         |           |
| 1.   | Allen B. Downey, “Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016.       |         |           |
| 2.   | John V Guttag, —Introduction to Computation and Programming Using Python,,,,, Revised and expanded Edition, MIT Press , 2013                            |         |           |
| 3.   | John V. Guttag,, Introduction to Computation and Programming using Python!, Prentice Hall of India, 2014.   |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1.   | <a href="http://greenteapress.com/wp/think-python/">http://greenteapress.com/wp/think- python/)</a>   |         |           |
| 2.   | <a href="https://www.python.org/about/gettingstarted/">https://www.python.org/about/gettingstarted/</a>   |         |           |
| 3.   | <a href="https://beginnersbook.com/2018/03/python-tutorial-learn-programming/">https://beginnersbook.com/2018/03/python-tutorial-learn-programming/</a> |         |           |
| 4.   | <a href="https://www.tutorialspoint.com/python/index.html">https://www.tutorialspoint.com/python/index.html</a>   |         |           |
| 5.   | <a href="https://www.google.com/www.udemy.com/PythonVideos/Online-Course">https://www.google.com/www.udemy.com/PythonVideos/Online-Course</a>           |         |           |





|  |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
|--|---|--------------------------|-------------|-------------|-------------|---------------|-----------------|-------------|-------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
| Programme  | <b>B.E</b>  | Programme Code           | <b>102</b>  | Regulation  | <b>2019</b> |               |                 |             |             |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>   |                          |             | Semester    | <b>II</b>   |               |                 |             |             |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name   | Periods Per Week         |             |             | Credit      | Maximum Marks |                 |             |             |             |              |              |                       |              |              |              |              |
|  |   | L                        | T           | P           | C           | CA            | ESE             | Total       |             |             |              |              |                       |              |              |              |              |
| <b>U19GE202</b>  | <b>Basic Civil and Mechanical Engineering*</b>  | 3                        | 0           | 0           | 3           | 40            | 60              | 100         |             |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | <p>The student should be made to,</p> <ul style="list-style-type: none"> <li>Familiarize the materials and measurements used in Civil Engineering.</li> <li>Provide the exposure on the fundamental elements of civil engineering components and structures.</li> <li>Impart basic knowledge of power plants, pumps &amp; boilers.</li> <li>Study the various types of IC engines and understand the features of IC engine.</li> <li>Enable the students to distinguish the components and working principle of refrigeration and air conditioning system.</li> </ul> |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| <b>Course Outcomes</b>   | At the end of the course, the student should be able to   |                          |             |             |             |               | Knowledge Level |             |             |             |              |              |                       |              |              |              |              |
|  | <b>CO 1:</b> Explain the usage of civil engineering materials and measure the location of points in surveying   |                          |             |             |             |               | K2              |             |             |             |              |              |                       |              |              |              |              |
|  | <b>CO 2:</b> Identify the nature of building components, structures and material Qualities.   |                          |             |             |             |               | K1              |             |             |             |              |              |                       |              |              |              |              |
|  | <b>CO 3:</b> Classify the various types of power plant, pump, turbine & boiler  |                          |             |             |             |               | K2              |             |             |             |              |              |                       |              |              |              |              |
|  | <b>CO 4:</b> Compare spark ignition and compression ignition of two stroke and four stroke engine.  |                          |             |             |             |               | K2              |             |             |             |              |              |                       |              |              |              |              |
| <b>CO 5:</b> Elaborate the working principle of refrigeration and air conditioning system. |   |                          |             |             |             | K3            |                 |             |             |             |              |              |                       |              |              |              |              |
| <b>Pre - requisites</b>  | Nil   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
|  | <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |                          |             |             |             |               |                 |             |             |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
|  | <b>COs</b>  | Programme Outcomes (POs) |             |             |             |               |                 |             |             |             |              |              |                       | PSOs         |              |              |              |
|  |   | <b>PO 1</b>              | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b>   | <b>PO 6</b>     | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
|  | <b>CO 1</b>   | 3                        | 3           | 3           | 2           | 3             |                 |             |             |             |              |              |                       | 3            | 2            |              |              |
|  | <b>CO 2</b>   | 3                        | 3           | 3           | 2           | 3             |                 |             |             |             |              |              |                       | 3            | 2            |              |              |
|  | <b>CO 3</b>   | 3                        | 2           | 2           |             | 2             |                 |             |             |             |              |              |                       | 2            | 3            |              |              |
|  | <b>CO 4</b>   | 3                        | 3           | 2           |             | 2             |                 |             |             |             |              |              |                       | 2            |              |              |              |
| <b>CO 5</b>  | 3   | 2                        | 2           |             | 2           |               |                 |             |             |             |              |              | 2                     |              |              |              |              |
| <b>Course Assessment Methods</b>   |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| 1. Continuous Assessment Test I, II & III  |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| 2. Assignment  |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| 3. End-Semester examination  |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |
| 1. Course - end survey   |   |                          |             |             |             |               |                 |             |             |             |              |              |                       |              |              |              |              |



| <b>Content of the Syllabus</b>   |  |                |           |
|--|--|----------------|-----------|
| <b>Unit – I</b>  | <b>CIVIL ENGINEERING MATERIALS AND SURVEYING</b>   | <b>Periods</b> | <b>9</b>  |
| Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel sections.<br>Surveying: Introduction to Surveying & Leveling.  |  |                |           |
| <b>Unit - II</b>   | <b>BUILDING COMPONENTS AND STRUCTURES</b>  | <b>Periods</b> | <b>9</b>  |
| Foundations: Site selection, Foundation – Types – Requirement of good foundations.<br>Superstructure: Brick masonry – Stone masonry – Beams – Columns – Lintels – Roofing – Flooring - Plastering.   |  |                |           |
| <b>Unit - III</b>  | <b>POWER PLANT ENGINEERING</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction, Classification of Power Plants – Boiler - Working principle of steam , Gas , Diesel , Hydro-Electric, Solar, Wind and Nuclear Power plants – Merits and Demerits – Pumps and turbines – Working principle of reciprocating pumps (single acting and double acting) – Centrifugal Pump. |  |                |           |
| <b>Unit - IV</b>   | <b>IC ENGINES</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction to Electric vehicles- Internal combustion engines as automotive power plant – Four stroke and two stroke cycles – Working of SI and CI engines - Comparison of four stroke and two stroke engines.  |  |                |           |
| <b>Unit - V</b>  | <b>REFRIGERATION AND AIR CONDITIONING SYSTEM</b>   | <b>Periods</b> | <b>9</b>  |
| Terminology of refrigeration and air conditioning. Principle of vapour compression and vapour absorption refrigeration system – Layout of typical domestic refrigerator – Window and split type room air conditioner.  |  |                |           |
| <b>Total Periods</b>   |  |                | <b>45</b> |
| <b>Text Book:</b>  |  |                |           |
| 1.   | Dr.P.Kannan, “Basic Mechanical Engineering”, JBR Tri Sea Publishers Pvt. Ltd., 2019.   |                |           |
| 2.   | Pravin Kumar, “Basic Mechanical Engineering”, Pearson Publishers, New Delhi, 2013.   |                |           |
| <b>References</b>  |  |                |           |
| 1.   | Dr.S.Ramachandaran, “ Basic Civil and Mechanical Engineering ” Air Walk Publication,2016   |                |           |
| 2.   | R.Gupta, “Basic Civil Engineering”, RPH Publication, 2016.   |                |           |
| 3.   | Mrs.V.Valarmathi, Mr.K.Rajasekar & Mr.T.Satheeskumar,“Basic Civil Engineering”, JBR Tri Sea Publishers Pvt. Ltd., 2017.                |                |           |
| 4.   | G.Shanmugam and M.S Palanichamy, “Basic Civil and Mechanical Engineering ”,Tata McGraw Hill Publishing Company Limited, New Delhi,2014 |                |           |
| 5.   | S.Seetharaman, “ Basic Civil Engineering ”,Anuradha Agencies,2005  |                |           |
| <b>E-Resources:</b>  |  |                |           |
| 1.   | <a href="https://nptel.ac.in/downloads/105105104/">https://nptel.ac.in/downloads/105105104/</a>  |                |           |
| 2.   | <a href="https://nptel.ac.in/courses/112107216/">https://nptel.ac.in/courses/112107216/</a>  |                |           |
| 3.   | <a href="http://link.springer.com/">http://link.springer.com/</a> “Basic Civil and Mechanical Engineering”-Springer Nature.            |                |           |



|  |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
|--|--|------------------|-------------|-------------|-------------|---------------|--|------------------------|-------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
|                    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code   |             |             |             | <b>102</b>    | Regulation   | <b>2019</b>            |             |              |              |              |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             |             | Semester      |  |                        | <b>II</b>   |              |              |              |                       |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit      | Maximum Marks |  |                        |             |              |              |              |                       |              |              |              |
|  |  | L                | T           | P           |             | C             | CA   | ESE                    | Total       |              |              |              |                       |              |              |              |
| <b>U19EE202</b>  | <b>Electric Circuit Theory</b>   | 3                | 0           | 0           | 3           | 40            | 60   | 100                    |             |              |              |              |                       |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Impart knowledge on solving circuit equations using network theorems</li> <li>Learn the phenomenon of resonance and coupled circuits.</li> <li>Learn the transient response of circuits.</li> <li>Learn the three phase system and two port networks</li> </ul> |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |             |             |             |               |  | <b>Knowledge Level</b> |             |              |              |              |                       |              |              |              |
|  | <b>CO1:</b> Understand the basic laws, mesh current, nodal voltage methods for solving circuit problems.   |                  |             |             |             |               |  | K2                     |             |              |              |              |                       |              |              |              |
|  | <b>CO2:</b> Understand the basic network theorems used for solving networks with both DC and AC inputs.  |                  |             |             |             |               |  | K2                     |             |              |              |              |                       |              |              |              |
|  | <b>CO3:</b> Understand the concepts and terminologies behind series & parallel resonance circuits and time response of circuit parameters.   |                  |             |             |             |               |  | K2                     |             |              |              |              |                       |              |              |              |
|  | <b>CO4:</b> Understand the analysis of three phase 3 wire and 4 wire circuits with star and delta connected loads and the concept of power and power factor measurement in three phase circuits.   |                  |             |             |             |               |  | K2                     |             |              |              |              |                       |              |              |              |
|  | <b>CO5:</b> Understand the two-port networks and its interconnections.   |                  |             |             |             |               |  | K2                     |             |              |              |              |                       |              |              |              |
| <b>Pre-requisites</b>  | -  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                  |             |             |             |               |  |                        |             |              |              |              | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |             |             |             |               |  |                        |             |              |              |              | PSOs                  |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b>  | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 2                |             |             |             |               |  |                        |             |              |              | 2            | 3                     |              | 2            |              |
| <b>CO 2</b>  | 3  | 3                | 2           |             |             |               |  |                        |             |              |              | 2            | 3                     | 2            | 2            |              |
| <b>CO 3</b>  | 3  | 3                | 2           |             |             |               |  |                        |             |              |              | 2            | 3                     | 2            | 3            |              |
| <b>CO 4</b>  | 3  | 2                |             |             |             |               |  |                        |             |              |              | 2            | 3                     |              | 2            |              |
| <b>CO 5</b>  | 3  | 2                |             | 2           |             |               |  |                        |             |              |              | 2            | 3                     |              | 2            |              |
| <b>Course Assessment Methods</b>   |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| <b>Direct</b>  |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| 1. Continuous Assessment Test I, II & III  |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| 2. Assignment  |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| 3. End-Semester examinations   |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |
| 1. Course – end Survey   |  |                  |             |             |             |               |  |                        |             |              |              |              |                       |              |              |              |

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>DC AND AC STEADY STATE ANALYSIS</b>  | <b>Periods</b> | <b>9</b>  |
| Definition of Voltage, Current, Power, Energy, Power factor, Circuit parameters, - Ohm's law - Kirchoff's law - Concept of DC circuits - Concepts of AC Circuits - RMS value, Average value, Form and Peak factors - Mesh, Node and Loop analysis - Concept of real and reactive power. |   |                |           |
| <b>Unit - II</b>  | <b>NETWORK THEOREMS</b>   | <b>Periods</b> | <b>9</b>  |
| Voltage source – current source transformations, Various Network theorems - Superposition Theorem – Thevenin's and Norton's Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem and applications to dc and ac circuits, Star-Delta transformations.                          |   |                |           |
| <b>Unit – III</b>   | <b>RESONANCE AND COUPLED CIRCUIT</b>  | <b>Periods</b> | <b>9</b>  |
| Resonance in series and parallel circuits - Analysis of coupled circuits - Coefficient of coupling - Dot convention - Self and Mutual induction.  |   |                |           |
| <b>Unit - IV</b>  | <b>THREE PHASE SYSTEMS</b>  | <b>Periods</b> | <b>9</b>  |
| Generation of three phase systems – Three phase star and delta circuits with balanced and unbalanced loads - symmetrical components – Measurement of Power and Power factor in three phase systems - Problems.  |   |                |           |
| <b>Unit – V</b>   | <b>TWO PORT NETWORK AND TRANSIENT RESPONSE</b>  | <b>Periods</b> | <b>9</b>  |
| Two Port Networks, Terminal pairs, Relationship of two port variables, Impedance parameters, Admittance parameters, Transmission parameters and hybrid parameters - Interconnections of two port networks. Time response of RL, RC and RLC circuits for step input.                     |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | C. K. Alexander and M. N. O. Sadiku, “Fundamental of Electric Circuits”, McGraw Hill Education, 4 <sup>th</sup> edition. 2004   |                |           |
| 2.  | W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.   |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Robins & Miller, “Circuit Analysis Theory and Practice”, Delmar Publishers, 5th Edition, 2012.  |                |           |
| 2.  | K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.   |                |           |
| 3.  | D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.   |                |           |
| 4.  | Theodore F. Bogart, “Electric Circuits”, McGraw Hill Electricity and Electronic services, 2 <sup>nd</sup> Edition, Glencoe Publishers, 1992   |                |           |
| 5.  | Mahmood Nahvi and Joseph Edminister, “Electric circuits”, McGraw Hill, 5th Edition. 2010  |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses/117106108/">https://nptel.ac.in/courses/117106108/</a>   |                |           |
| 2.  | <a href="http://www.ee.iitm.ac.in/videolectures/doku.php?id=ec1010_2014nk:start">http://www.ee.iitm.ac.in/videolectures/doku.php?id=ec1010_2014nk:start</a>   |                |           |
| 3.  | <a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/lecture-notes/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/lecture-notes/</a> |                |           |



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|   |   |                  |     |            |               |               |     |       |
|---|---|------------------|-----|------------|---------------|---------------|-----|-------|
| Programme   | B.E/B.TECH  | Programme code   | 102 | Regulation | 2019          |               |     |       |
| Department  | ELECTRICAL AND ELECTRONICS ENGINEERING                                      |                  |     | Semester   | II            |               |     |       |
| Course code   | Course name   | Periods per week |     |            | Credit        | Maximum Marks |     |       |
|   |   | L                | T   | P          | C             | CA            | ESE | Total |
| U19TN201  | தமிழர்மரபு/Heritage of Tamils   | 2                | 0   | 0          | 1             | 40            | 60  | 100   |
| Content of the syllabus   |   |                  |     |            |               |               |     |       |
| அலகு 1  | மொழி மற்றும் இலக்கியம்  |                  |     |            | Periods       | 3             |     |       |
| இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க் காப்பியங்கள் தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. |   |                  |     |            |               |               |     |       |
| அலகு 2  | மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை                |                  |     |            | Periods       | 3             |     |       |
| நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை. யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவல்களின் பங்கு.   |   |                  |     |            |               |               |     |       |
| அலகு 3  | நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:                             |                  |     |            | Periods       | 3             |     |       |
| தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.  |   |                  |     |            |               |               |     |       |
| அலகு 4  | தமிழர்களின் திணைக் கோட்பாடுகள்:   |                  |     |            | Periods       | 3             |     |       |
| தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.   |   |                  |     |            |               |               |     |       |
| அலகு 5  | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: |                  |     |            | Periods       | 3             |     |       |
| இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தில் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.   |   |                  |     |            |               |               |     |       |
|   |   |                  |     |            | Total Periods | 15            |     |       |





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|   |  |                  |          |            |                |               |     |       |
|---|--|------------------|----------|------------|----------------|---------------|-----|-------|
| Programme   | B.E/B.TECH   | Programme code   | 102      | Regulation | 2019           |               |     |       |
| Department  | ELECTRICAL AND ELECTRONICS ENGINEERING                                       |                  | Semester |            | II             |               |     |       |
| Course code   | Course name  | Periods per week |          |            | Credit         | Maximum Marks |     |       |
|   |  | L                | T        | P          | C              | CA            | ESE | Total |
| <b>U19TN201</b>   | <b>தமிழர்மரபு/ Heritage of Tamils</b>  | 2                | 0        | 0          | 1              | 40            | 60  | 100   |
|   | <b>Content of the syllabus</b>   |                  |          |            |                |               |     |       |
| <b>UNIT I</b>   | <b>LANGUAGE AND LITERATURE</b>   |                  |          |            | <b>Periods</b> | <b>3</b>      |     |       |
| Language Families in India-Dravidian Languages-Tamil as a Classical Language-Classical Literature in Tamil Secular Nature of Sangam Literature-Distributive Justice in Sangam Literature-Management Principles in Thirukural-Tamil Epics and Impact of Buddhism & Jainism in Tamil Land-Bakthi Literature Azhwars and Nayanmars-Forms of minor Poetry-Development of Modern literature in Tamil-Contribution of Bharathiyar and Bharathidhasan. |  |                  |          |            |                |               |     |       |
| <b>UNIT II</b>  | <b>HERITAGE-ROCK ART PAINTINGS TO MODERN ART-SCULPTURE</b>                   |                  |          |            | <b>Periods</b> | <b>3</b>      |     |       |
| Herostone to modern sculpture-Bronze icons-Tribes and their handicrafts- Art of temple carmaking—Massive Terra cotta sculptures Village deities,Thiruvalluvar Statue at Kanyakumari,Making of musical instruments-Mridhangam,Parai Veenai,Yazhand Nadhaswaram-Role of Temples in Social and Economic Life of Tamils.  |  |                  |          |            |                |               |     |       |
| <b>UNIT III</b>   | <b>FOLK AND MARTIAL ARTS</b>   |                  |          |            | <b>Periods</b> | <b>3</b>      |     |       |
| Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu ,Oyillattam, Leatherpuppetry,Silambattam,Valari, Tiger dance-Sports and Games of Tamils.  |  |                  |          |            |                |               |     |       |
| <b>UNIT IV</b>  | <b>THINAI CONCEPT OF TAMILS</b>  |                  |          |            | <b>Periods</b> | <b>3</b>      |     |       |
| Flora and Fauna of Tamils & Ahamand Puram Concept from Tholkappiyam and Sangam Literature-Aram Concept of Tamils- Education and Literacy during Sangam Age-Ancient Cities and Ports of Sangam Age-Export and Import during Sangam Age- Overseas Conquest of Cholas.   |  |                  |          |            |                |               |     |       |
| <b>UNIT V</b>   | <b>CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE</b> |                  |          |            | <b>Periods</b> | <b>3</b>      |     |       |
| Contribution of a mils to Indian Freedom Struggle-The Cultural Influence of Tamils over the other parts of India-Self-Respect Movement-Role of Siddha Medicine in Indigenous Systems of Medicine-Inscriptions & Manuscripts-Print History of Tamil Books.   |  |                  |          |            |                |               |     |       |

**Text cum-Reference Books**

|    |  |
|----|--|
| 1  | தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).   |
| 2  | கணிணித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).   |
| 3  | கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)   |
| 4  | பொருளை -ஆற்றங்கரை நகரிகம்.(தொல்லியல் துறை வெளியீடு)  |
| 5  | SocialLifeofTamils(Dr.K.K.Pillay)AjointpubhcatlonofTNTB&ESCandRMRL   |
| 6  | Life of the Tamils-The Classical Period (Dr.S.Singaravelu) (Published by :International Institute of Tamil Studies.  |
| 7  | Historical Heritage of the Tamiks (Dr.S.V.Subatamarnan,Dr.K.D.Thirunavukkarasu)(Publishedby:International Institute Of Tamil Studies}.                                       |
| 8  | The Contributions of the Tamils to Indian Culture (Dr.M.Valarmath1)(Publishedby:InternationalInstituteofTamilStudies)  |
| 9  | Keeladi- 'Sangam City Civilization on the bank sof river Vaigai' (Jointly Pubhshedby:DepartmentofArchaeology&TamilNaduTextBookandEducationalServices Corporation, TamilNadu) |
| 10 | Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby:The Author).   |
| 11 | Porunai Civilization (Jointly Published by: Department of Archaeology & TamilNadu Text Book and Educational Services Corporation, TamilNadu)                                 |
| 12 | JourneyofCivilizationIndustoVaigai(R.Balakrishnan)(Publishedby:RMRL)– Reference Book.  |

|  |  |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
|--|--|------|----------------|------------------|------|------|--------|---------------|------------|-------|---|-------------|-----------------------|-------|-------|-------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |      |                |                  |      |      |        |               |            |       |  |             |                       |       |       |       |
| Programme  | <b>B.E.</b>  |      | Programme Code |                  |      |      |        | <b>102</b>    | Regulation |       |   | <b>2019</b> |                       |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |      |                |                  |      |      |        | Semester      |            |       | <b>II</b>   |             |                       |       |       |       |
| Course Code  | Course Name  |      |                | Periods Per Week |      |      | Credit | Maximum Marks |            |       |   |             |                       |       |       |       |
|  |  |      |                | L                | T    | P    | C      | CA            | ESE        | Total |   |             |                       |       |       |       |
| <b>U19PH208</b>  | <b>PHYSICS LABORATORY<sup>s</sup></b>  |      |                | 0                | 0    | 4    | 2      | 60            | 40         | 100   |   |             |                       |       |       |       |
| <b>Course Objective</b>  | The main objective of this course is to:   |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
|  | <ul style="list-style-type: none"> <li>• Understand elastic behavior of Materials</li> <li>• Predict viscous force in liquids.</li> <li>• Gain knowledge in measuring the lowest thickness materials</li> <li>• To Identify wavelengths of prominent lines using polychromatic lamp</li> <li>• Observe heat conduction in bad conductor</li> <li>• Understand the principle of interferometer</li> <li>• • To learn about the characteristics of Lasers</li> </ul> |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
| <b>Course Outcome</b>  | The students who complete this course successfully are expected to   |      |                |                  |      |      |        |               |            |       | Knowledge Level   |             |                       |       |       |       |
|  | <b>CO1:</b> Calculate young's modulus of the materials.  |      |                |                  |      |      |        |               |            |       | K2  |             |                       |       |       |       |
|  | <b>CO2:</b> Calculate Coefficient of viscosity of liquid.  |      |                |                  |      |      |        |               |            |       | K2  |             |                       |       |       |       |
|  | <b>CO3:</b> Calculate thickness of thin wire using Air wedge.  |      |                |                  |      |      |        |               |            |       | K1  |             |                       |       |       |       |
|  | <b>CO4:</b> Observe and measure different wavelengths of mercury Spectrum.   |      |                |                  |      |      |        |               |            |       | K1  |             |                       |       |       |       |
|  | <b>CO5:</b> Illustrate the conductivity of bad conductors  |      |                |                  |      |      |        |               |            |       | K2  |             |                       |       |       |       |
|  | <b>CO6:</b> To know how to determine the velocity of ultrasonic waves in liquid  |      |                |                  |      |      |        |               |            |       | K1  |             |                       |       |       |       |
| <b>CO7:</b> To understand the importance of laser beam compared to ordinary light                  |  |      |                |                  |      |      |        |               |            | K2    |   |             |                       |       |       |       |
| <b>Pre-requisites</b>  | ---  |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |      |                |                  |      |      |        |               |            |       |   |             | <b>CO/PSO Mapping</b> |       |       |       |
| <b>COs</b>   | Programme Outcomes (POs)   |      |                |                  |      |      |        |               |            |       |   |             | PSOs                  |       |       |       |
|  | PO 1   | PO 2 | PO 3           | PO 4             | PO 5 | PO 6 | PO 7   | PO 8          | PO 9       | PO 10 | PO 11   | PO 12       | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3  | -    | 3              |                  |      |      |        |               |            |       |   |             | 1                     |       | 2     |       |
| CO 2   | 3  | 3    | 1              |                  |      |      |        |               |            |       |   |             |                       |       | 3     |       |
| CO 3   | 3  | 2    | 2              |                  |      |      |        |               |            |       |   |             |                       |       | 3     |       |
| CO 4   | 3  | 3    | 2              |                  |      |      |        |               |            |       |   |             |                       |       | 3     |       |
| CO 5   | 3  | -    | 1              |                  |      |      |        |               |            |       |   |             |                       |       | 1     |       |
| <b>Course Assessment Methods</b>   |  |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
| <b>Direct</b>  |  |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
| 1. Pre lab and post lab test   |  |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |
| 2. End-Semester examinations   |  |      |                |                  |      |      |        |               |            |       |   |             |                       |       |       |       |

|                                |  |            |
|--------------------------------|--|------------|
| <b>Indirect</b>                |  |            |
| 1. Course – end survey         |  |            |
| <b>CONTENT OF THE SYLLABUS</b> |  |            |
| <b>S.No.</b>                   | <b>Experiments</b>   | <b>CO</b>  |
| 1.                             | Determination of Young’s modulus of the material - Uniform bending method                    | <b>CO1</b> |
| 2.                             | Determination of Young’s modulus of the material - Non uniform bending method                | <b>CO1</b> |
| 3.                             | Determination of Rigidity modulus – Torsion pendulum   | <b>CO1</b> |
| 4.                             | Determination of Coefficient of viscosity of a liquid – Poiseuille’s method                  | <b>CO2</b> |
| 5.                             | Determination of thickness of a thin material – Air wedge method                             | <b>CO2</b> |
| 6.                             | Determination of wavelength of mercury spectrum – spectrometer grating                       | <b>CO3</b> |
| 7.                             | Determination of Dispersive power of a prism – Spectrometer                                  | <b>CO3</b> |
| 8.                             | Determination of thermal conductivity of metallic glass using Lee’s Disc Method              | <b>CO4</b> |
| 9.                             | Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer | <b>CO4</b> |
| 10.                            | Determination of Wavelength and particle size using Laser                                    | <b>CO5</b> |
| <b>Total Periods</b>           |  | <b>45</b>  |
| <b>Lab Manual</b>              |  |            |
| 1.                             | R. Jayaraman, Engineering Physics Laboratory Manual ,Pearson Pub,Edition-2018.               |            |
| 2.                             | A.K. Katiyar &C.K. PandeyEngineering Physics: Theory and Practical,Wiley Pub,2 nd Edition.   |            |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
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|  |  |                  |            |            |             |               |                 |     |
|--|--|------------------|------------|------------|-------------|---------------|-----------------|-----|
| Programme  | <b>B.Tech</b>  | Programme Code   | <b>105</b> | Regulation | <b>2019</b> |               |                 |     |
| Department   | <b>Electrical &amp; Electronics Engineering</b>  |                  |            | Semester   | <b>II</b>   |               |                 |     |
| Course Code  | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                 |     |
|  |  | L                | T          | P          |             | C             | CA              | ESE |
| <b>U19GE203</b>  | <b>Engineering Practices Laboratory</b>  | 0                | 0          | 4          | 2           | 50            | 50              | 100 |
| <b>Course Objective</b>  | <b>The main objective of this course is to:</b>  |                  |            |            |             |               |                 |     |
|  | <p>The students should made to</p> <ul style="list-style-type: none"> <li>Know the plumbing line assemblies.</li> <li>Weld lap joint, butt joint and T-joint.</li> <li>Learn the assembling and dismantling methodology of home appliances.</li> <li>Learn the resistor value identification through colors coated on resistor.</li> <li>Learn the basics of signal generation in CRO.</li> <li>Learn the soldering techniques in PCB board for designing the projects.</li> </ul> |                  |            |            |             |               |                 |     |
| <b>Course Outcomes</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               | Knowledge Level |     |
|  | <b>CO1:</b> Perform basic machining operations and finish the job to the requirements and quantify the accuracy.   |                  |            |            |             |               | K2              |     |
|  | <b>CO2:</b> Make various joints such as cross lap joint and Tee lap joint in the carpentry.  |                  |            |            |             |               | K2              |     |
|  | <b>CO3:</b> Understand the basics of house wiring techniques and the measurements of basic electrical quantities.  |                  |            |            |             |               | K2              |     |
|  | <b>CO4:</b> Understand the resistor value identification through colors coated on resistor.  |                  |            |            |             |               | K2              |     |
| <b>CO5:</b> Understand the soldering techniques in PCB board for designing the projects. |  |                  |            |            |             | K2            |                 |     |
| <b>re -requisites</b>  | Nil  |                  |            |            |             |               |                 |     |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 |
| CO 1  | 3                        | 2    | 3    | 2    | 2    | -    | -    | -    | 2    | -     | -     | -     | 2              | 2     | -     |
| CO 2  | 3                        | 2    | 3    | 2    | 2    | -    | -    | -    | 2    | -     | -     | -     | 3              | 2     | -     |
| CO 3  | 3                        | 2    | 2    | 3    | 2    | 2    | -    | -    | 2    | -     | -     | -     | 2              | -     | -     |
| CO 4  | 3                        | 2    | 2    | 3    | 2    | 2    | -    | -    | 2    | -     | -     | -     | 2              | -     | -     |
| CO 5  | 3                        | 2    | 3    | 3    | 2    | 2    | -    | -    | 2    | -     | -     | -     | 3              | 3     | -     |



| <b>Course Assessment Methods</b>  |     |
|---|-----|
| <b>Direct</b>   |     |
| 1.Pre lab and Post lab test<br>2. Record mark<br>3.End- Semester Examinations   |     |
| <b>Indirect</b>   |     |
| 1.Course –End survey  |     |
| <b>Content of the Syllabus</b>  |     |
| <b><u>GROUP A</u></b><br><b><u>(CIVIL &amp; MECHANICAL ENGINEERING)</u></b><br><b><u>(CIVIL ENGINEERING PRACTICE)</u></b>   |     |
| <b>Plumbing :</b><br>1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.                                       | CO2 |
| 2. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components  | CO2 |
| <b>Carpentry:</b><br>3. Study of the joints in roofs, doors, windows and furniture.   | CO2 |
| 4. Hands-on-exercise: Wood work, joints by sawing, planning and cutting.  | CO2 |
| <b><u>MECHANICAL ENGINEERING PRACTICE</u></b>   |     |
| <b>Welding:</b><br>5. Preparation of arc welding of butt joints, lap joints and tee joints.   | CO1 |
| 6. Gas welding practice   | CO1 |
| <b>Basic Machining:</b><br>7. Turning and Facing.   | CO1 |
| 8.Drilling Practice   | CO1 |
| <b>Sheet Metal Work:</b><br>9. Forming & Bending  | CO1 |
| 10. Model making – Tray and Basket.   | CO1 |
| <b>4.Demonstration on:</b><br>(a) Foundry operations like mould preparation for gear and step cone pulley.<br>(b) Fitting – Exercises – Preparation of square fitting and vee – fitting models. |     |
| <b>5. Study of Air Conditioner &amp; Centrifugal Pump.</b>  |     |
| <b><u>GROUP B</u></b><br><b><u>(ELECTRICAL &amp; ELECTRONICS ENGINEERING)</u></b><br><b><u>III. ELECTRICAL ENGINEERING PRACTICE</u></b>   |     |
| 1. Residential house wiring and stair case wiring using switches, fuse, indicator & lamp.   | CO3 |
| 2. Fluorescent lamp wiring.   | CO3 |
| 3. Measurement of voltage, current, power & power factor using R-Load.  | CO3 |
| 4. Measurement of energy using single phase meter.  | CO3 |
| 5. Measurement of resistance to earth of electrical equipment.  | CO3 |

|   |   |
|---|---|
| 6. Measurement of illumination to earth of electrical equipment.                    | CO3   |
| 7. Study of batteries.  | CO3   |
| <b>IV. <u>ELECTRONICS ENGINEERING PRACTICE</u></b>                                  |   |
| 1. Study of Electronic components and equipments – Resistor, colour coding.         | CO4   |
| 2. Study of logic gates AND, OR, NOR, NAND and NOT.                                 | CO4   |
| 3. Generation of Clock Signal.  | CO4   |
| 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB | CO5   |
| <b>Total Periods</b>  |   |
| <b>45</b>   |   |
| <b>Reference Book :</b>   |   |
| R1.   | Dr.P.Kannan, Mr.T.Satheeskumar & Mr.K.Rajasekar, “Engineering Practices Laboratory” Manual. First Edition, 2017.  |
| R2.   | Mr.T.Jeyapoovan, Mr.M.Saravana Pandian, “Engineering Practices Lab” Manual, Vikas Publishing House Pvt Ltd, 2017. |





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|   |   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
|---|---|------------------|------|------|----------|---------------|-----------|-----------------|-------|-------|-------|-----------------------|-------|-------|-------|-------|
| Programme   | <b>B.E.</b>   | Programme code   |      |      |          | Regulation    |           | 2019            |       |       |       |                       |       |       |       |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |      |      | Semester |               | <b>II</b> |                 |       |       |       |                       |       |       |       |       |
| Course code   | Course name   | Periods per week |      |      | Credit   | Maximum Marks |           |                 |       |       |       |                       |       |       |       |       |
|   |   | L                | T    | P    |          | C             | CA        | ESE             | Total |       |       |                       |       |       |       |       |
| <b>U19MCFY1</b>   | <b>Environmental Science and Engineering</b>  | 3                | 0    | 0    | 0        | 100           | -         | 100             |       |       |       |                       |       |       |       |       |
| Objective   | The students should be made to <ul style="list-style-type: none"> <li>Familiarize basics of ecosystem and creating environmental awareness.</li> <li>Congregate quality and standards requirement of water.</li> <li>Contrast water management procedures.</li> <li>Acquire knowledge on air pollution and its control.</li> <li>Summarize Solid waste and its prevention methods.</li> </ul> |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
| Outcomes  | At the end of the course, the student should be able to,  |                  |      |      |          |               |           | Knowledge Level |       |       |       |                       |       |       |       |       |
|   | <b>CO1:</b> Distinguish the types of Ecosystem and implicit the knowledge.  |                  |      |      |          |               |           | K1              |       |       |       |                       |       |       |       |       |
|   | <b>CO2:</b> Recognize quality, standard and control strategies of polluted water.   |                  |      |      |          |               |           | K3              |       |       |       |                       |       |       |       |       |
|   | <b>CO3:</b> Infer and express air pollution and its control.  |                  |      |      |          |               |           | K3              |       |       |       |                       |       |       |       |       |
|   | <b>CO4:</b> Acquire Knowledge about Radioactive pollution and disposal method   |                  |      |      |          |               |           | K3              |       |       |       |                       |       |       |       |       |
|   | <b>CO5:</b> Aweraness about population growth, human rights and Environment   |                  |      |      |          |               |           | K2              |       |       |       |                       |       |       |       |       |
| Pre-requisites  | Nil   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |   |                  |      |      |          |               |           |                 |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |       |
| COs   | Programme Outcomes (POs)  |                  |      |      |          |               |           |                 |       |       |       | PSOs                  |       |       |       |       |
|   | PO 1  | PO 2             | PO 3 | PO 4 | PO 5     | PO 6          | PO 7      | PO 8            | PO 9  | PO 10 | PO 11 | PO 12                 | PS O1 | PS O2 | PSO 3 | PSO 4 |
| CO 1  | 3   |                  | 1    |      |          |               | 1         |                 |       |       | 1     | 2                     |       |       |       |       |
| CO 2  | 1   | 2                | 2    |      |          | 2             | 3         |                 |       |       |       | 3                     |       |       | 1     |       |
| CO 3  | 2   | 2                | 1    |      |          | 3             | 3         |                 |       |       | 1     | 2                     |       |       |       |       |
| CO 4  | 1   | 1                | 1    |      |          | 2             | 3         |                 |       |       | 1     | 2                     |       |       |       |       |
| CO 5  | 1   | 2                | 1    |      |          | 2             | 2         |                 |       |       | 1     | 3                     |       |       |       |       |
| <b>Course Assessment Methods</b>  |   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
| <b>Direct</b>   |   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
| <ol style="list-style-type: none"> <li>Continuous Assessment Test I, II &amp;III</li> <li>Assignment: Simulation using tool</li> <li>End-Semester examinations</li> </ol> |   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
| <b>Indirect</b>   |   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |
| <ol style="list-style-type: none"> <li>Course – end survey</li> </ol>   |   |                  |      |      |          |               |           |                 |       |       |       |                       |       |       |       |       |

| <b>Content of the syllabus</b>   |  |                |                      |
|--|--|----------------|----------------------|
| <b>Unit - I</b>  | <b>INTRODUCTION TO ENVIRONMENTAL SCIENCE AND ENGINEERING</b>                       | <b>Periods</b> | <b>9</b>             |
| Nature and scope of environmental education- Natural Resources – (Forest, Water, Food, Energy & Land Resources) problems, Ecosystem and Biodiversity- Ecosystem-Structure, Characteristics and functions of ecosystem (in general)- Biodiversity – Definition – Conservation of Biodiversity (in-situ and Ex-situ)- Environmental awareness and sustainable development                                  |  |                |                      |
| <b>Unit - II</b>   | <b>WATER POLLUTION AND WASTE WATER TREATMENT PROCESS.</b>                          | <b>Periods</b> | <b>9</b>             |
| Water pollution-causes, effects and control measures of water pollution- case study- Waste water treatment process- Primary, Secondary, Tertiary and desalination -Water quality parameters- Hardness, Alkalinity, DO, COD, BOD-Water quality standard- WHO and BIS.   |  |                |                      |
| <b>Unit - III</b>  | <b>AIR POLLUTION AND ITS CONTROL</b>   | <b>Periods</b> | <b>9</b>             |
| Air Pollution – Types of Air pollutants-CO <sub>2</sub> , SO <sub>2</sub> , NO <sub>2</sub> , PAN etc Sources- causes, effects (Acid rain, Green house effect, Ozone layer depletion and global warming)- control measures (Electro static precipitator, Gravitational settling chamber, Baghouse filter, Wet Scrubber and cyclone separator).   |  |                |                      |
| <b>Unit - IV</b>   | <b>RADIOACTIVE POLLUTION AND SOLID WASTE MANAGEMENT</b>                            | <b>Periods</b> | <b>9</b>             |
| Radioactive pollutants-sources, effects, Nuclear Energy – Nuclear Fusion – Nuclear Fission-Nuclear power plant- Light water nuclear power plant- Diagram- illustration- working – pollution- impacts-and control measures- case study- solid waste-definition-Types of solid waste- Disposal method and its problem in solid waste management- Significance for prevention of hazardous waste management |  |                |                      |
| <b>Unit - V</b>  | <b>HUMAN POPULATION AND THE ENVIRONMENT</b>  | <b>Periods</b> | <b>9</b>             |
| Population growth, Human rights, Value education, environment and Human health, Family welfare Program, Women and Child welfare, Role of information technology in environment – Satellite, Data base, Geographical Information System (GIS), Environmental impact Analysis (EIA) and Human health   |  |                |                      |
|  |  |                | <b>Total Periods</b> |
|  |  |                | <b>45</b>            |
| <b>Text books</b>  |  |                |                      |
| 1.   | Dr.S. Vairam, “Environment Science and Engineering” Gems publication. Edition 2018 |                |                      |
| 2.   | Gilbert.M.Masters-“Environmental Science”-Pearson education. Edition-2-2013        |                |                      |
| <b>Reference books</b>   |  |                |                      |
| 1.   | Linda Williams- “Environmental Science”-Tata McGRAW – Hill Edition. Edition-I-2008 |                |                      |
| 2.   | T.G.Miller Jr-“Environmental Science”-Wadsworth publishing Co. Edition -10-2004    |                |                      |
| 3.   | William P. Cunningham, Barbara Woodworth Saigo- Tata McGraw Hill.Edition-4-2011    |                |                      |
| 4.   | NPTEL Course Notes   |                |                      |
| 5.   | Cunnighum and cooper-“Environmental Science”-Jaico Publ, House Edition-4-2007      |                |                      |
| <b>E-Resources</b>   |  |                |                      |
| 1.   | <a href="https://libraries.ou.edu/">https://libraries.ou.edu/</a>                  |                |                      |
| 2.   | <a href="https://libguides.reading.ac.uk/">https://libguides.reading.ac.uk/</a>    |                |                      |
| 3.   | <a href="https://libguides.reading.ac.uk/">https://libguides.reading.ac.uk/</a>    |                |                      |

|  |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
|--|--|------------------|------|------|--------|---------------|------------|------------|------|----------|-------------|--|-----------------------|-------|-------|-------|
|                    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| Programme  | <b>B.E</b>   | Programme Code   |      |      |        |               | <b>102</b> | Regulation |      |          | <b>2019</b> |  |                       |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      |        |               | Semester   |            |      | <b>I</b> |             |  |                       |       |       |       |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit | Maximum Marks |            |            |      |          |             |  |                       |       |       |       |
|  |  | L                | T    | P    | C      | CA            | ESE        | Total      |      |          |             |  |                       |       |       |       |
| <b>U19MCFY2</b>  | <b>Indian Constitution and Universal Human Values</b>  | 3                | 0    | 0    | 0      | 100           | 0          | 100        |      |          |             |  |                       |       |       |       |
| <b>Course Objective</b>  | The students should be made to <ul style="list-style-type: none"> <li>know about Indian constitution.</li> <li>know about central and state government functionalities in India</li> <li>know about Indian society.</li> </ul>                           |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| <b>Outcome Course</b>  | At the end of the course, the student should be able to,   |                  |      |      |        |               |            |            |      |          |             | Knowledge level  |                       |       |       |       |
|  | CO 1: Understand the functions of the Indian government  |                  |      |      |        |               |            |            |      |          |             | K1   |                       |       |       |       |
|  | CO2: Understand and abide the rules of the Indian constitution   |                  |      |      |        |               |            |            |      |          |             | K1   |                       |       |       |       |
|  | CO3: Understand and appreciate different culture among the people  |                  |      |      |        |               |            |            |      |          |             | K1   |                       |       |       |       |
|  | CO4: Understanding human being as a co-existence of the sentient „I“ and the material  |                  |      |      |        |               |            |            |      |          |             | K1, K2   |                       |       |       |       |
|  | CO5: „Body“ and the needs of Self („I“) and „Body“ and Ability to utilize the professional competence for augmenting universal human order and Ability to identify the scope and characteristics of people-friendly and eco friendly Production systems. |                  |      |      |        |               |            |            |      |          |             | K2   |                       |       |       |       |
| <b>Pre-requisites</b>  | ---  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                  |      |      |        |               |            |            |      |          |             |  | <b>CO/PSO Mapping</b> |       |       |       |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |      |      |        |               |            |            |      |          |             |  | PSOs                  |       |       |       |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5   | PO 6          | PO 7       | PO 8       | PO 9 | PO 10    | PO 11       | PO 12  | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   |  |                  |      |      | 3      |               | 3          | 2          |      |          |             |  |                       |       |       |       |
| CO 2   |  |                  |      |      | 3      |               | 3          | 3          |      |          |             |  |                       |       |       |       |
| CO 3   |  |                  |      |      | 3      |               | 3          | 2          |      |          |             |  |                       |       |       |       |
| CO 4   |  |                  |      |      | 3      |               | 3          | 3          |      |          |             |  |                       |       |       |       |
| CO 5   |  |                  |      |      | 3      |               | 3          | 3          |      |          |             |  |                       |       |       |       |
| <b>Course Assessment Methods</b>   |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| <b>Direct</b>  |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| 1. Continuous Assessment Test I, II & III  |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| 2. Assignment: Simulation using tool   |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| 3. End-Semester examinations   |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| <b>Indirect</b>  |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |
| 1. Course – end survey   |  |                  |      |      |        |               |            |            |      |          |             |  |                       |       |       |       |

| <b>Content of the syllabus</b>  |  |         |           |
|---|--|---------|-----------|
| <b>Unit – I</b>   | <b>INTRODUCTION</b>  | Periods | <b>9</b>  |
| Historical Background – Constituent Assembly of India – Fundamental Rights – Citizenship – Constitutional Remedies for citizens   |  |         |           |
| <b>Unit - II</b>  | <b>STRUCTURE AND FUNCTION OF CENTRAL</b>   | Periods | <b>9</b>  |
| Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India           |  |         |           |
| <b>Unit – III</b>   | <b>STRUCTURE AND FUCTION OF STATE</b>  | Periods | <b>9</b>  |
| State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts |  |         |           |
| <b>Unit - IV</b>  | <b>Universal Human Values</b>  | Periods | <b>9</b>  |
| Course Introduction - Need, Basic Guidelines, Content and Process for Value Education   |  |         |           |
| <b>Unit – V</b>   | <b>OPTOEL Universal Human Values - Professional Ethics ECTRONICS</b>   | Periods | <b>9</b>  |
| Understanding Harmony in the Human Being - Harmony in Myself and society.   |  |         |           |
| <b>Total Periods</b>  |  |         | <b>45</b> |
| <b>Text Books</b>   |  |         |           |
| 1.  | Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.   |         |           |
| 2.  | Tanushukla, Human Values and professional Ethics, Cengage publications.  |         |           |
| <b>References</b>   |  |         |           |
| 1.  | R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi  |         |           |
| 2.  | Indian polity, M.Laksmikanth, Tatamchrawhill publications  |         |           |
| 3.  | R R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2 |         |           |
| <b>E-Resources</b>  |  |         |           |
| 1.  | <a href="https://mhrd.gov.in/">https://mhrd.gov.in/</a>  |         |           |
| 2.  | <a href="https://niti.gov.in/content/niti-aayog-library">https://niti.gov.in/content/niti-aayog-library</a>  |         |           |
| 3.  | <a href="http://www.drishtias.com/">www.drishtias.com/</a>   |         |           |



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|                         |  |                  |            |            |             |               |                 |       |
|-------------------------|--|------------------|------------|------------|-------------|---------------|-----------------|-------|
| Programme               | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |       |
| Department              | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   | <b>III</b>  |               |                 |       |
| Course Code             | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                 |       |
|                         |  | L                | T          | P          | C           | CA            | ESE             | Total |
| <b>U19MA303</b>         | <b>Transforms and Partial Differential Equations</b>   | 3                | 1          | 0          | 4           | 40            | 60              | 100   |
| <b>Course Objective</b> | The students should be made to   |                  |            |            |             |               |                 |       |
|                         | <ul style="list-style-type: none"> <li>Introduce the basic concepts of PDE for solving standard partial differential equations</li> <li>Solve boundary value problems by using Fourier series.</li> <li>Acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.</li> <li>A acquaint the student with Fourier transform techniques used in wide variety of situations.</li> </ul> Introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems. |                  |            |            |             |               |                 |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               | Knowledge level |       |
|                         | <b>CO1</b> Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.  |                  |            |            |             |               | K2,K4           |       |
|                         | <b>CO2:</b> Understand how to solve the given standard partial differential equations  |                  |            |            |             |               | K3,K4           |       |
|                         | <b>CO3:</b> Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.  |                  |            |            |             |               | K3,K5           |       |
|                         | <b>CO4:</b> Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.  |                  |            |            |             |               | K2,K5           |       |
|                         | <b>CO5:</b> Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.  |                  |            |            |             |               | K1,K3           |       |
| <b>Pre-requisites</b>   | -  |                  |            |            |             |               |                 |       |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 |
| CO 1  | 3                        | 3    |      |      |      |      |      |      |      |       |       |       | 2              |       |       |
| CO 2  | 3                        | 3    |      |      |      |      |      |      |      |       |       |       | 2              |       |       |
| CO 3  | 3                        | 3    |      |      |      |      |      |      |      |       |       |       | 2              |       |       |
| CO 4  | 3                        | 3    |      |      |      |      |      |      |      |       |       |       | 2              |       |       |
| CO 5  | 3                        | 3    |      |      |      |      |      |      |      |       |       |       | 2              |       |       |

**Signature of the BOS Chairman, EEE**

| <b>Course Assessment Methods</b>  |  |         |           |
|---|--|---------|-----------|
| <b>Direct</b>   |  |         |           |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment: Simulation using tool<br>3. End-Semester examinations   |  |         |           |
| <b>Indirect</b>   |  |         |           |
| 1. Course - end survey  |  |         |           |
| <b>Content of the syllabus</b>  |  |         |           |
| <b>Unit – I</b>   | <b>FOURIER SERIES</b>  | Periods | <b>12</b> |
| Dirichlet's conditions – General Fourier series – Change of interval – Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.  |  |         |           |
| <b>Unit - II</b>  | <b>PARTIAL DIFFERENTIAL EQUATIONS</b>  | Periods | <b>12</b> |
| Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Singular integral - Solution of Standard types of first order partial differential equations - Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients. |  |         |           |
| <b>Unit – III</b>   | <b>APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS</b>  | Periods | <b>12</b> |
| Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (excluding insulated edges).   |  |         |           |
| <b>Unit - IV</b>  | <b>FOURIER TRANSFORM</b>   | Periods | <b>12</b> |
| Fourier Integral theorem (without proof) – Fourier transform pair – Properties (without proof) – Transforms of simple functions – Fourier Sine and Cosine transforms – Properties (without proof) – Convolution theorem and Parseval's identity (Statement and applications only).  |  |         |           |
| <b>Unit – V</b>   | <b>Z – TRANSFORM</b>   | Periods | <b>12</b> |
| Definition – Z-transform of some basic functions – Elementary properties – Inverse Z-transform: Partial fraction method – Residue method – Initial and Final value theorem- Convolution theorem – Applications of Z-transforms: Solution of difference equations.   |  |         |           |
| <b>Total Periods</b>  |  |         | <b>60</b> |
| <b>Text Books</b>   |  |         |           |
| 1.  | Grewal B.S., "Higher Engineering Mathematics", 43 <sup>rd</sup> Edition, Khanna Publishers, Delhi, 2014.                           |         |           |
| 2.  | Churchill, R.V. and Brown, J. W., Fourier series and boundary value problems.(8 <sup>th</sup> Edition), McGraw-Hill, 2011.         |         |           |
| <b>References</b>   |  |         |           |
| 1.  | Veerarajan T, Engineering Mathematics, McGraw Hill Education, 2013.  |         |           |
| 2.  | Kreyszig, E., Advanced Engineering Mathematics (10th Edition), John Wiley (2015).  |         |           |
| 3.  | Ramana.B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company Limited, New Delhi, 2008.                      |         |           |
| 4.  | P.R.Vittal, "Differential equations Fourier and Laplace Transforms", Margham Publishers, 2 <sup>nd</sup> Edition, 1999.            |         |           |
| 5.  | Ray Wylie. C and Barrett.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi 2012. |         |           |
| <b>E-Resources</b>  |  |         |           |
| 1.  | <a href="https://learnengineering.in">https://learnengineering.in</a>  |         |           |
| 2.  | <a href="http://www.learnerstv.com/Free-engineering-Video-lectures">www.learnerstv.com/Free-engineering-Video-lectures</a>         |         |           |
| 3.  | <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>   |         |           |



|  |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
|--|---|------|----------------|------|------|------------------|------------|------|------------|---------------|--|-----------------------|-------|------|------|------|
|                    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| Programme  | <b>B.E.</b>   |      | Programme Code |      |      |                  | <b>102</b> |      | Regulation |               | <b>2019</b>  |                       |       |      |      |      |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |      |                |      |      |                  | Semester   |      |            | <b>III</b>    |  |                       |       |      |      |      |
| Course Code  | Course Name   |      |                |      |      | Periods Per Week |            |      | Credit     | Maximum Marks |  |                       |       |      |      |      |
|  |   |      |                |      |      | L                | T          | P    |            | C             | CA   | ESE                   | Total |      |      |      |
| <b>U19EE303</b>  | <b>Analog Electronics</b>   |      |                |      |      | 3                | 0          | 0    | 3          | 40            | 60   | 100                   |       |      |      |      |
| <b>Course Objective</b>  | The student should be made to,  |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
|  | <ul style="list-style-type: none"> <li>Understand the electronic semiconductor devices &amp; circuits giving importance to the various aspects of design &amp; analysis.</li> <li>Understand the different types of filter &amp; oscillator circuits and their design.</li> <li>Learn the concept of small signal and large signal amplifiers.</li> <li>Familiarize the students with feedback amplifiers and its applications</li> </ul> |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |      |                |      |      |                  |            |      |            |               | Knowledge Level  |                       |       |      |      |      |
|  | <b>CO1:</b> Design biasing scheme for transistor circuits   |      |                |      |      |                  |            |      |            |               | K2   |                       |       |      |      |      |
|  | <b>CO2:</b> Choose the proper signal amplifier for electronic circuit applications  |      |                |      |      |                  |            |      |            |               | K4   |                       |       |      |      |      |
|  | <b>CO3:</b> Understand the operation of feedback amplifiers and its various applications  |      |                |      |      |                  |            |      |            |               | K4   |                       |       |      |      |      |
|  | <b>CO4:</b> Choose the oscillator for specific applications.  |      |                |      |      |                  |            |      |            |               | K2   |                       |       |      |      |      |
|  | <b>CO5:</b> Choose the filter and regulator for specific applications.  |      |                |      |      |                  |            |      |            |               | K3   |                       |       |      |      |      |
| <b>Pre-requisites</b>  | -   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |   |      |                |      |      |                  |            |      |            |               |  | <b>CO/PSO Mapping</b> |       |      |      |      |
| <b>COs</b>   | Programme Outcomes (POs)  |      |                |      |      |                  |            |      |            |               |  |                       | PSOs  |      |      |      |
|  | PO 1  | PO 2 | PO 3           | PO 4 | PO 5 | PO 6             | PO 7       | PO 8 | PO 9       | PO 10         | PO 11  | PO 12                 | PSO1  | PSO2 | PSO3 | PSO4 |
| <b>CO 1</b>  | 3   |      |                |      |      |                  |            |      |            |               |  | 3                     | 2     |      |      |      |
| <b>CO 2</b>  | 3   | 2    |                |      | 2    |                  |            |      |            |               |  | 3                     | 3     | 2    | 3    |      |
| <b>CO 3</b>  | 2   | 2    | 1              |      | 2    |                  |            |      |            |               |  | 3                     | 3     | 2    | 3    |      |
| <b>CO 4</b>  | 2   |      | 2              |      |      |                  |            |      |            |               |  | 3                     | 3     |      |      |      |
| <b>CO 5</b>  | 1   | 2    | 2              |      |      |                  |            |      |            |               |  | 3                     | 2     |      |      | 3    |
| <b>Course Assessment Methods</b>   |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| <b>Direct</b>  |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| 1. Continuous Assessment Test I, II & III  |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| 2. Assignment  |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| 3. End-Semester examinations   |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| <b>Indirect</b>  |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |
| 1.Course - end survey  |   |      |                |      |      |                  |            |      |            |               |  |                       |       |      |      |      |

| <b>Content of the syllabus</b>   |   |         |           |
|--|---|---------|-----------|
| <b>Unit – I</b>  | <b>SEMICONDUCTOR DEVICES</b>  | Periods | <b>9</b>  |
| Review of Diodes, transistor, FET, UJT- characteristics. Biasing of BJT-AC analysis of BJT and FET.  |   |         |           |
| <b>Unit - II</b>   | <b>SIGNAL AMPLIFIERS</b>  | Periods | <b>9</b>  |
| Small signal amplifiers(CE,CB,CC configuration) -Large signal amplifiers - class A and class B power amplifiers, class C and class D amplifiers -Tuned amplifiers.   |   |         |           |
| <b>Unit – III</b>  | <b>FEEDBACK AMPLIFIERS</b>  | Periods | <b>9</b>  |
| Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on input and output characteristics, Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components and their analysis. |   |         |           |
| <b>Unit - IV</b>   | <b>OSCILLATORS</b>  | Periods | <b>9</b>  |
| RCoscillators(RCPhaseshiftoscillatorandWeinBridgeoscillator)–LCoscillators(HartleyandColpitt"s)- Derivation of frequency of oscillation for the above mentioned oscillators- Crystal oscillator  |   |         |           |
| <b>Unit – V</b>  | <b>FILTERS AND REGULATORS</b>   | Periods | <b>9</b>  |
| Introduction of Filter and it types (Inductor filter, Capacitor filter, L-section filter, P- section filter, Multiple L-section and Multiple P-section filter), Simple circuit of a regulator using zener diode, Series and Shunt voltage regulators.  |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
| 1.   | David A.Bell, “Electronic Devices and Circuits”, 3rd Edition, Prentice Hall of India, 2008.   |         |           |
| 2.   | Robet.L.Boylestad, “Electronic Circuits and Circuit Theory”, Pearson, 10th Edition, 2009.   |         |           |
| <b>References</b>  |   |         |           |
| 1.   | Millman and Halkias, “Electronic Devices and Circuits”, Tata McGraw Hill 3rd Edition, 2010.   |         |           |
| 2.   | Gayakwad.R.A, “Op-amps and Linear Integrated Circuits”, Prentice Hall of India, New Delhi, 4th Edition, 2002.                           |         |           |
| 3.   | Roy Choudhery.D and Sheil B. Jain, “Linear Integrated Circuits”, New Age Publishers, 2nd Edition, 2011.                                 |         |           |
| 4.   | Boylestad R. L. and L. Nashelsky, Electronic Devices and Circuit Theory, 10/e, Pearson Education India, 2009.                           |         |           |
| 5.   | Sedra Smith, “Microelectronic Circuits”, Oxford university Press, 6th Edition, 2013.  |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1.   | <a href="http://www.electronics-tutorials.ws/diode/diode_3.html">http://www.electronics-tutorials.ws/diode/diode_3.html</a>             |         |           |
| 2.   | <a href="http://www.electronics-tutorials.ws/transistor/tran_4.html">http://www.electronics-tutorials.ws/transistor/tran_4.html</a>     |         |           |
| 3.   | <a href="http://www.electronics-tutorials.ws/opamp/opamp_4.html">http://www.electronics-tutorials.ws/opamp/opamp_4.html</a>             |         |           |
| 4.   | <a href="http://www.electronics-tutorials.ws/waveforms/555_timer.html">http://www.electronics-tutorials.ws/waveforms/555_timer.html</a> |         |           |





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|  |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
|--|---|------------------|------------|------------|-------------|---------------|-----------------|-------|-----|------|------|-----------------------|------|------|------|------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |       |     |      |      |                       |      |      |      |      |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>III</b>  |               |                 |       |     |      |      |                       |      |      |      |      |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |                 |       |     |      |      |                       |      |      |      |      |
|  |   | L                | T          | P          | C           | CA            | ESE             | Total |     |      |      |                       |      |      |      |      |
| <b>U19EE304</b>  | <b>Digital Logic Circuits</b>   | 3                | 0          | 0          | 3           | 40            | 60              | 100   |     |      |      |                       |      |      |      |      |
| <b>Course Objective</b>  | The student should be made to, <ul style="list-style-type: none"> <li>• Acquire the basic knowledge of digital logic levels and application</li> <li>• Understand the knowledge about digital electronics circuits.</li> <li>• Analysis of various digital electronic circuits..</li> </ul> |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |            |            |             |               | Knowledge Level |       |     |      |      |                       |      |      |      |      |
|  | <b>CO1:</b> Understand different number systems and various logic families and their uses in digital electronics.   |                  |            |            |             |               | K1              |       |     |      |      |                       |      |      |      |      |
|  | <b>CO2:</b> Design and Implement the Combinational Circuits   |                  |            |            |             |               | K2              |       |     |      |      |                       |      |      |      |      |
|  | <b>CO3:</b> Analyze the simplification of synchronous sequential circuits   |                  |            |            |             |               | K1              |       |     |      |      |                       |      |      |      |      |
|  | <b>CO4:</b> Analyze the simplification of asynchronous sequential circuits  |                  |            |            |             |               | K4              |       |     |      |      |                       |      |      |      |      |
| <b>CO5:</b> Identify the logic families and memory devices   |   |                  |            |            |             | K4            |                 |       |     |      |      |                       |      |      |      |      |
| <b>Pre-requisites</b>  | -   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| <b>CO / PO Mapping</b>   |   |                  |            |            |             |               |                 |       |     |      |      | <b>CO/PSO Mapping</b> |      |      |      |      |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak  |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| POs  | Programme Outcomes (POs)  |                  |            |            |             |               |                 |       |     |      |      |                       | PSOs |      |      |      |
|  | PO1   | PO2              | PO3        | PO4        | PO5         | PO6           | PO7             | PO8   | PO9 | PO10 | PO11 | PO12                  | PSO1 | PSO2 | PSO3 | PSO4 |
| 1  | 3   |                  |            |            |             |               |                 |       |     |      |      |                       | 2    |      |      |      |
| 2  | 3   | 3                | 3          |            |             |               |                 |       |     |      |      |                       | 2    |      |      |      |
| 3  | 3   | 3                | 3          |            |             |               |                 |       |     |      |      |                       | 2    |      |      |      |
| 4  | 3   | 3                | 3          |            |             |               |                 |       |     |      |      |                       | 2    |      |      |      |
| 5  |   |                  |            | 2          |             |               |                 |       |     |      |      |                       | 1    |      |      |      |
| <b>Course Assessment Methods</b>   |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| <b>Direct</b>  |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp; III</li> <li>2. Assignment</li> <li>3. End-Semester examinations</li> </ol> |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| <b>Indirect</b>  |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |
| <ol style="list-style-type: none"> <li>1. Course - end survey</li> </ol>   |   |                  |            |            |             |               |                 |       |     |      |      |                       |      |      |      |      |

| <b>Content of the syllabus</b>   |  |         |           |
|--|--|---------|-----------|
| <b>Unit – I</b>  | <b>BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES</b>   | Periods | <b>9</b>  |
| Introduction to number systems, binary codes, error detection and correction codes. Axioms and Laws of Boolean Algebra - Reducing Boolean - Expressions – Boolean Functions and their representation-Expansion of a Boolean Expression in SOP Form to the standard - SOP Form- Expansion of a Boolean Expression in POS Form to standard POS Form - Minimization of Switching Functions: Two Variable K Map- Three Variable K Map - Four Variable K Map – Implementation of Logic Functions-Quine McCluskey Method: Don't care conditions. |  |         |           |
| <b>Unit – II</b>   | <b>COMBINATIONAL LOGIC DESIGN</b>  | Periods | <b>9</b>  |
| Design Procedure: Adders - Subtractors. Code converters: Binary to Gray - Gray to Binary - BCD to Excess 3 - BCD to Gray. Encoders: Octal to Binary Encoder - Decoders: 3 Line to 8 Line Decoder - 2 Line to 4 Line Decoder with NAND Gates- Multiplexers – Demultiplexers.  |  |         |           |
| <b>Unit – III</b>  | <b>SYNCHRONOUS SEQUENTIAL CIRCUITS</b>   | Periods | <b>9</b>  |
| Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters – asynchronous and synchronous type – Modulo counters - Shift registers – Ring counters.  |  |         |           |
| <b>Unit – IV</b>   | <b>ASYNCHRONOUS SEQUENTIAL CIRCUITS</b>  | Periods | <b>9</b>  |
| Synchronous Sequential Logic circuits-state table and excitation tables state diagrams-Moore and Mealy models-design of counters-analysis of synchronous sequential logic circuits-state reduction and state assignment.   |  |         |           |
| <b>Unit – V</b>  | <b>LOGIC FAMILIES AND MEMORY</b>   | Periods | <b>9</b>  |
| Digital Logic Families -Introduction to RTL, DTL, TTL, ECL and MOSL families - wired and operation, characteristics of digital logic family - comparison of different logic families. Memory Organization and operation - Semiconductor RAMs: Static RAMs (SRAMs)- Dynamic RAMs(DRAMs). Read-Only Memory (ROM)-ROM organization – Types of ROMs- Programmable ROM (PROM). - Introduction to digital system design using Verilog.   |  |         |           |
| <b>Total Periods</b>   |  |         | <b>45</b> |
| <b>Text Books</b>  |  |         |           |
| 1.   | Anand Kumar A., _Fundamentals of Digital Circuits,,, 2nd Edition, Prentice Hall of India, 2013   |         |           |
| 2.   | Morris Mano M., Digital Design with an Introduction to the Verilog,,, 5th Edition, Pearson Education, 2013.  |         |           |
| <b>References</b>  |  |         |           |
| 1.   | Salivahanan, S and Arivazhagan, —Digital Circuits and Designl, 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012                          |         |           |
| 2.   | Donald Leach, Albert Malvino and GoutamSaha, —Digital Principles and Applicationsl, 8th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014. |         |           |
| 3.   | CharlesH.Roth,JrandLizyKurianJohn,—DigitalSystemDesignusingVHDLl,2ndEdition,Cengage Learning, 2012.  |         |           |
| <b>E-Resources</b>   |  |         |           |
| 1.   | <a href="http://web.iitd.ac.in/~shouri/eel201/lectures.php">http://web.iitd.ac.in/~shouri/eel201/lectures.php</a>                                      |         |           |
| 2.   | <a href="http://www.nptel.ac.in/courses/106108099//Digital%20Systems.pdf">http://www.nptel.ac.in/courses/106108099//Digital%20Systems.pdf</a>          |         |           |

|   |  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
|---|--|------------------|------|------|--------|---------------|------------|---|-------|------|-------|-----------------------|------|-------|-------|------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |      |      |        |               |            |  |       |      |       |                       |      |       |       |      |
| Programme   | <b>B.E.</b>  | Programme Code   |      |      |        | <b>102</b>    | Regulation | <b>2019</b>   |       |      |       |                       |      |       |       |      |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      |        | Semester      |            | <b>III</b>  |       |      |       |                       |      |       |       |      |
| Course Code   | Course Name  | Periods Per Week |      |      | Credit | Maximum Marks |            |   |       |      |       |                       |      |       |       |      |
|   |  | L                | T    | P    |        | C             | CA         | ESE   | Total |      |       |                       |      |       |       |      |
| <b>U19EE305</b>   | <b>Electromagnetic Fields</b>  | 4                | 0    | 0    | 3      | 40            | 60         | 100   |       |      |       |                       |      |       |       |      |
| <b>Course Objective</b>   | The student should be made to, <ul style="list-style-type: none"> <li>• Understand the Concepts of electrostatics, electrical potential, energy density and their applications.</li> <li>• Understand the Concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.</li> <li>• Faraday's laws, induced emf and their applications in the concepts of electromagnetic waves and pointing vector.</li> </ul> |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |      |      |        |               |            | Knowledge Level   |       |      |       |                       |      |       |       |      |
|   | <b>CO1:</b> Understand about the scalar and vector fields ,co-ordinate systems   |                  |      |      |        |               |            | K2  |       |      |       |                       |      |       |       |      |
|   | <b>CO2:</b> Analyze about electrostatics and the various laws associated with it.  |                  |      |      |        |               |            | K3  |       |      |       |                       |      |       |       |      |
|   | <b>CO3:</b> Understand about the basics of magneto statics   |                  |      |      |        |               |            | K4  |       |      |       |                       |      |       |       |      |
|   | <b>CO4:</b> Understand about the Electrodynamics Fields and Electromagnetic fields.  |                  |      |      |        |               |            | K6  |       |      |       |                       |      |       |       |      |
| <b>CO5:</b> Apply the application of electromagnetic waves with pointing vector.  |  |                  |      |      |        |               | K6         |   |       |      |       |                       |      |       |       |      |
| <b>Pre-requisites</b>   | -  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |  |                  |      |      |        |               |            |   |       |      |       | <b>CO/PSO Mapping</b> |      |       |       |      |
| COs   | Programme Outcomes (POs)   |                  |      |      |        |               |            |   |       |      |       | PSOs                  |      |       |       |      |
|   | PO 1   | PO 2             | PO 3 | PO 4 | PO 5   | PO 6          | PO7        | PO8   | PO 9  | PO10 | PO 11 | PO12                  | PSO1 | PSO 2 | PSO 3 | PSO4 |
| CO 1  | 3  | 3                | 3    |      | 1      |               |            | 1   |       |      | 2     | 2                     | 2    | 1     | 1     | 1    |
| CO 2  | 3  | 2                | 3    |      | 2      |               |            | 1   |       |      | 2     | 2                     | 2    | 1     | 1     | 1    |
| CO 3  | 3  | 3                | 3    |      | 2      |               |            | 1   |       |      | 2     | 3                     | 2    | 1     | 1     | 1    |
| CO 4  | 3  | 2                | 3    |      | 1      |               |            | 1   |       |      | 2     | 3                     | 2    | 1     | 1     | 1    |
| CO 5  | 3  | 3                | 3    |      | 1      |               |            | 1   |       |      | 2     | 3                     | 2    | 1     | 1     | 1    |
| <b>Course Assessment Methods</b>  |  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
| <b>Direct</b>   |  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp;III</li> <li>2. Assignment</li> <li>3. End-Semester examinations</li> </ol> |  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
| <b>In Direct</b>  |  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |
| <ol style="list-style-type: none"> <li>1. Course - end survey</li> </ol>  |  |                  |      |      |        |               |            |   |       |      |       |                       |      |       |       |      |

| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>INTRODUCTION</b>   | Periods | <b>12</b> |
| Scalar and Vector fields – Different co-ordinate systems- vector calculus, gradient, divergence and curl, Laplacian operator. Volume and line integrals, surface integrals, Divergence and Stoke's theorem.   |   |         |           |
| <b>Unit - II</b>  | <b>ELECTROSTATICS</b>   | Periods | <b>12</b> |
| Coulomb's Law and concept of Electric Field -Divergence Theorem and Gauss' Law -Concept of Electrostatic Potential, Poisson's Equation -Energy in the Field, Capacitance -capacitance of common two-plate capacitors, including two-wire capacitors- Dielectrics, dielectric boundary conditions. |   |         |           |
| <b>Unit – III</b>   | <b>MAGNETOSTATICS</b>   | Periods | <b>12</b> |
| ForceduetoaMagneticfield,ForceduetocombinedElectricandMagneticfields-Biot-Savart Law, calculation of Magnetic Field for simple coil configurations-Ampere's Law -Magnetic flux, Stokes theorem - Magnetic materials, magnetic boundary conditions -Force on a dipole                              |   |         |           |
| <b>Unit - IV</b>  | <b>ELECTRODYNAMIC FIELDS</b>  | Periods | <b>12</b> |
| Emf,electromagneticinduction,Faraday'slawforacircuit,interpretationofFaraday'semf;self-inductance,inductance of long solenoid, coaxial cylinders, parallel cylinders; mutual inductance; transformers; magnetic energy density.   |   |         |           |
| <b>Unit – V</b>   | <b>ELECTROMAGNETIC WAVES</b>  | Periods | <b>12</b> |
| TheDisplacementcurrent.Maxwell'sEquation-Thewaveequationin1-Dimension-Solutionofthewave equation. Plane waves -Wave propagation in vacuum and lossy dielectrics-Skin depth and frequency dependence of lumped elements-The Poynting vector.Poynting theorem. Impedance matching.                  |   |         |           |
| <b>Total Periods</b>  |   |         | <b>60</b> |
| <b>Text Books</b>   |   |         |           |
| 1   | William H. Hayt, Jr. Engineering Electromagnetics - Fifth Edition. TMH.1999                                     |         |           |
| 2.  | Joseph.A.Edminister,,Schaum'sOutlineofElectromagnetics,ThirdEdition(Schaum'sOutline Series), McGraw Hill, 2010. |         |           |
| <b>References</b>   |   |         |           |
| 1.  | K..A.Gangadhar,,ElectromagneticfieldTheory",KhannaPublishers;ighthReprint:2015                                  |         |           |
| 2.  | KrausandFleish,,ElectromagneticswithApplications",McGrawHillInternationalEditions,Fifth Edition, 2010.          |         |           |
| 3.  | J.R.Reitz, F.J.Milford and R.W.Christie,“Foundations of Electromagnetic Theory”, Addison Wesley (2008).         |         |           |
| 4.  | S.Subhasri, Electromagnetic fields, New age international publications.   |         |           |
| 5.  | R.Gowri., Electromagnetic fields and waves. S.K.Kataria and sons, Publisher of Engineering and Computer book.   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | <a href="http://www.nptelvideos.in/">http://www.nptelvideos.in/</a>   |         |           |
| 2.  | <a href="https://ocw.mit.edu/index.htm">https://ocw.mit.edu/index.htm</a>                                       |         |           |
| 3.  | <a href="https://www.electrical4u.com/emf/">https://www.electrical4u.com/emf/</a>                               |         |           |

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|---|--|-----|------------------|-----|-----|--------|---------------|------------|-----------------|------------|-------------|--|-----------------------|-------|------|-------|
| Programme   | <b>B.E.</b>  |     | Programme Code   |     |     |        |               | <b>102</b> | Regulation      |            | <b>2019</b> |  |                       |       |      |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |     |                  |     |     |        | Semester      |            |                 | <b>III</b> |             |  |                       |       |      |       |
| Course Code   | Course Name  |     | Periods Per Week |     |     | Credit | Maximum Marks |            |                 |            |             |  |                       |       |      |       |
|   |  |     | L                | T   | P   |        | C             | CA         | ESE             | Total      |             |  |                       |       |      |       |
| <b>U19EE306</b>   | <b>Measurements and Instrumentation</b>  |     | 3                | 0   | 0   | 3      | 40            | 60         | 100             |            |             |  |                       |       |      |       |
| <b>Course Objective</b>   | The student should be made to, <ul style="list-style-type: none"> <li>Understand the basic concepts of measuring instruments.</li> <li>Understand the operation of various analog instruments.</li> <li>Understand the operation of various digital instruments.</li> <li>Measure R, L and C elements using DC and AC bridges.</li> <li>Learn the principle and working of various transducers.</li> </ul> |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |     |                  |     |     |        |               |            | Knowledge Level |            |             |  |                       |       |      |       |
|   | <b>CO1:</b> Analyze the static and dynamic behavior of a measurement system and compare with standard system.  |     |                  |     |     |        |               |            | K2              |            |             |  |                       |       |      |       |
|   | <b>CO2:</b> Apply the concept of Faradays Law in various types of Analog Instruments and determine the types of errors associated with them.   |     |                  |     |     |        |               |            | K3              |            |             |  |                       |       |      |       |
|   | <b>CO3:</b> Analyze the characteristics and performance parameters of Digital instruments.   |     |                  |     |     |        |               |            | K2              |            |             |  |                       |       |      |       |
|   | <b>CO4:</b> Design a suitable bridge for the measurement of unknown resistance, Inductance and Capacitance.  |     |                  |     |     |        |               |            | K3              |            |             |  |                       |       |      |       |
| <b>Pre-requisites</b>   | -  |     |                  |     |     |        |               |            | K4              |            |             |  |                       |       |      |       |
|   | -  |     |                  |     |     |        |               |            | -               |            |             |  |                       |       |      |       |
| <b>CO / PO Mapping</b>  |  |     |                  |     |     |        |               |            |                 |            |             |  | <b>CO/PSO Mapping</b> |       |      |       |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak                   |  |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |
| Cos   | Programme Outcomes (POs)   |     |                  |     |     |        |               |            |                 |            |             |  | PSOs                  |       |      |       |
|   | PO1  | PO2 | PO3              | PO4 | PO5 | PO6    | PO7           | PO8        | PO 9            | PO 10      | PO 11       | PO12   | PSO1                  | PSO 2 | PSO3 | PSO 4 |
| CO 1  | 2  | 1   | 2                | 3   | 2   | 1      |               |            |                 |            |             | 2  | 3                     | 1     | 2    | 1     |
| CO 2  | 3  | 2   | 1                | 2   | 3   | 2      |               |            |                 |            |             | 1  | 2                     |       | 2    |       |
| CO 3  | 2  | 1   | 2                | 2   | 1   |        | 2             |            |                 |            | 1           | 1  | 2                     | 1     | 3    | 1     |
| CO 4  | 2  | 3   | 1                | 2   | 2   | 2      | 1             |            |                 |            | 1           | 2  | 1                     | 2     | 2    |       |
| CO 5  | 2  | 1   | 3                | 2   | 1   | 2      | 1             |            |                 |            | 2           | 1  | 2                     |       | 2    |       |
| <b>Course Assessment Methods</b>  |  |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |
| <b>Direct</b>   |  |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |
| 1. Continuous Assessment Test I, II &III<br>2. Assignment<br>3. End-Semester examinations |  |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |
| <b>Indirect</b>   |  |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |
| 1. Course - end survey  |  |     |                  |     |     |        |               |            |                 |            |             |  |                       |       |      |       |

| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>INTRODUCTION</b>   | Periods | <b>9</b>  |
| Units and dimensions, Functional elements of an instruments, Static and dynamic characteristics, Errors in measurement, Statistical evaluation of measurement data, Standards and calibration. Measuring Instruments: Classification, Absolute and secondary instruments, indicating instruments.                                   |   |         |           |
| <b>Unit – II</b>  | <b>ANALOG INSTRUMENTS</b>   | Periods | <b>9</b>  |
| Moving coil instruments: Permanent magnet moving coil instruments, Moving iron: Attraction and repulsion type instruments- Torque equations and errors, Single and Three phase watt meters and Energy meters, Single phase electro-dynamometer power factor meter.  |   |         |           |
| <b>Unit – III</b>   | <b>DIGITAL INSTRUMENTS</b>  | Periods | <b>9</b>  |
| Digital Multi-meter, Digital Voltmeter and its types-Digital Phase meter, Digital Energy meter, Digital Storage Oscilloscope (DSO), True RMS meters, Clamp meters, Power quality analyzer.  |   |         |           |
| <b>Unit – IV</b>  | <b>MEASUREMENT OF ELECTRICAL AND NON-ELECTRICAL QUANTITIES</b>  | Periods | <b>9</b>  |
| Measurement of Resistance: Kelvin double bridge, Wheatstone bridge, Measurement of inductance and capacitance: Maxwell and Schering bridge, Earth Resistance Tester, Wagner's earth fault indicator. Measurement of Temperature: Radiation and Optical pyrometer.   |   |         |           |
| <b>Unit – V</b>   | <b>TRANSDUCERS</b>  | Periods | <b>9</b>  |
| Selection of transducer, Classification of transducers: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Piezo-Electric transducers, Optical Transducer, Inductive torque transducers, Electric tachometers, Photo-electric tachometers, Hall Effect Transducer. |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | David A Bell, "Electronic Instrumentation and Measurements", Oxford Publisher 2017  |         |           |
| 2.  | E. O. Doebelin, Measurement Systems Application and Design, Tata McGraw Hill Publishing Company, 2007.  |         |           |
| <b>References</b>   |   |         |           |
| 1.  | A. K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Sons 2017.   |         |           |
| 2.  | Rangan C.S., Sharma G.R., Mani V.S., "Instrumentation Devices and Systems", McGraw Hill Education, Chennai 2017.  |         |           |
| 3.  | Albert D, Helfrick, William D Cooper, Modern Electronic Instrumentation and Measurement Techniques, Pearson Education, New Delhi 2016.  |         |           |
| 4.  | J. B. Gupta, A Course in Electronic and Electrical Measurements, S. K. Kataria & Sons, New Delhi, 2008.   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | <a href="https://onlinecourses.nptel.ac.in/noc19_ee44">https://onlinecourses.nptel.ac.in/noc19_ee44</a>   |         |           |
| 2.  | <a href="https://www.classcentral.com/course/swayam-electrical-measurement-and-electronic-instruments-14032">https://www.classcentral.com/course/swayam-electrical-measurement-and-electronic-instruments-14032</a> |         |           |
| 3.  | <a href="https://www.objectivebooks.com/2018/04/measurement-and-instrumentation.html">https://www.objectivebooks.com/2018/04/measurement-and-instrumentation.html</a>   |         |           |
| 4.  | <a href="https://gradeup.co/practice/quiz/electrical-engineering-exams/measurements-instrumentation">https://gradeup.co/practice/quiz/electrical-engineering-exams/measurements-instrumentation</a>                 |         |           |





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|   |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
|---|--|------------------|-----|-----|--------|---------------|------------|-----------------|-------|------|------|-----------------------|------|------|------|------|
| Programme   | <b>B.E.</b>  | Programme Code   |     |     |        | <b>102</b>    | Regulation | <b>2019</b>     |       |      |      |                       |      |      |      |      |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |     |     |        | Semester      |            | <b>III</b>      |       |      |      |                       |      |      |      |      |
| Course Code   | Course Name  | Periods Per Week |     |     | Credit | Maximum Marks |            |                 |       |      |      |                       |      |      |      |      |
|   |  | L                | T   | P   |        | C             | CA         | ESE             | Total |      |      |                       |      |      |      |      |
| <b>U19EE307</b>   | <b>DC MACHINES AND TRANSFORMERS</b>  | 2                | 1   | 0   | 3      | 40            | 60         | 100             |       |      |      |                       |      |      |      |      |
| <b>Course Objective</b>   | <p>The student should be made to,</p> <ul style="list-style-type: none"> <li>Understand the fundamentals of energy conversion and Magnetic-circuit analysis.</li> <li>Acquire the knowledge in working principles of DC Generator.</li> <li>Acquire the knowledge in working principles of DC Motor.</li> <li>Discuss the constructional details, principle of operation and prediction of performance, in the transformers.</li> <li>Acquire the knowledge in various testing of D.C. Machines and Transformers.</li> </ul> |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |     |     |        |               |            | Knowledge Level |       |      |      |                       |      |      |      |      |
|   | <b>CO1:</b> Understand the principle of electromagnetic energy conversion.   |                  |     |     |        |               |            | K2              |       |      |      |                       |      |      |      |      |
|   | <b>CO2:</b> Explain the performance characteristics of various DC Generators.  |                  |     |     |        |               |            | K2              |       |      |      |                       |      |      |      |      |
|   | <b>CO3:</b> Describe the performance characteristics of various DC Motors.   |                  |     |     |        |               |            | K3              |       |      |      |                       |      |      |      |      |
|   | <b>CO4:</b> Describe the equivalent circuit of transformers and determine its regulation.  |                  |     |     |        |               |            | K2              |       |      |      |                       |      |      |      |      |
| <b>Pre-requisites</b>   | Electrical Circuit Analysis  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
|   |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| <b>CO / PO Mapping</b>  |  |                  |     |     |        |               |            |                 |       |      |      | <b>CO/PSO Mapping</b> |      |      |      |      |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak   |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| COs   | Programme Outcomes (POs)   |                  |     |     |        |               |            |                 |       |      |      |                       | PSOs |      |      |      |
|   | PO1  | PO2              | PO3 | PO4 | PO5    | PO6           | PO7        | PO8             | PO9   | PO10 | PO11 | PO12                  | PSO1 | PSO2 | PSO3 | PSO4 |
| CO 1  |  | 1                | 2   |     |        |               |            | 1               | 2     |      |      | 1                     | 2    |      | 2    |      |
| CO 2  | 2  |                  | 2   | 2   | 1      |               |            |                 | 2     |      |      |                       | 2    |      |      |      |
| CO 3  |  |                  | 3   | 2   | 1      |               |            | 2               |       |      |      | 1                     | 3    | 1    |      |      |
| CO 4  | 2  | 3                |     | 1   |        |               |            | 1               |       |      | 1    |                       | 3    |      | 2    |      |
| CO 5  |  | 2                |     | 3   | 2      | 1             |            |                 |       |      | 1    |                       | 2    |      | 1    | 1    |
| <b>Course Assessment Methods</b>  |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| <b>Direct</b>   |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| <ol style="list-style-type: none"> <li>Continuous Assessment Test I, II &amp; III</li> <li>Assignment</li> <li>End-Semester examinations</li> </ol> |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| <b>Indirect</b>   |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |
| <ol style="list-style-type: none"> <li>Course – end survey</li> </ol>   |  |                  |     |     |        |               |            |                 |       |      |      |                       |      |      |      |      |

| <b>Content of the syllabus</b>   |   |         |           |
|--|---|---------|-----------|
| <b>Unit – I</b>  | <b>BASIC CONCEPTS OF ROTATING MACHINES</b>  | Periods | <b>9</b>  |
| Principles of electromechanical energy conversion – Force and Torque equations in magnetic fields – Energy and Force in single and multiple excited systems – MMF of distributed windings – Rotating magnetic field –Generated voltage- Torque in Wound rotor machine.   |   |         |           |
| <b>Unit – II</b>   | <b>DC GENERATORS</b>  | Periods | <b>9</b>  |
| DC Generator - construction, principle of operation - EMF equation – Methods of excitation – self and separately excited generators - Characteristics - Commutation - Armature reaction  |   |         |           |
| <b>Unit – III</b>  | <b>DC MOTORS</b>  | Periods | <b>9</b>  |
| Introduction- Principle of operation –Torque equation – Characteristics and application of series, shunt and compound motors – Types of starters – Speed control of dc shunt and series motors – Braking of dc shunt motor.  |   |         |           |
| <b>Unit – IV</b>   | <b>TRANSFORMERS</b>   | Periods | <b>9</b>  |
| Constructional details of core and shell type transformers- Types of winding- Principle of operation- EMF equation- Transformation ratio- Transformer on no-load- Parameters referred to HV/LV windings- Equivalent circuit- Transformer on load- Regulation- Parallel operation of single and three phase transformers- Auto transformer- Three phase transformers. |   |         |           |
| <b>Unit – V</b>  | <b>TESTING OF DC MACHINES AND TRANSFORMERS</b>  | Periods | <b>9</b>  |
| Losses and efficiency in DC machines and transformers - Testing of DC machines: Brake test, Swinburne’s test and Hopkinson’s test – testing of transformers-load test, open circuit and short circuit tests – Sumpner’s test- All day efficiency.  |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
| 1.   | Dr.P.S.Bimbhra, “Electrical Machinery”, Khanna Publishers, 7 <sup>th</sup> Edition, 2013.   |         |           |
| 2.   | I. J. Nagrath, D.P. Kothari, Electric Machines, 4 <sup>th</sup> Edition, TMH, New Delhi, 2014.  |         |           |
| <b>References</b>  |   |         |           |
| 1.   | Abhijith Chakrabarti, Sudipta Debnath, Electrical Machines, McGraw Hill Education, New Delhi 2015.  |         |           |
| 2.   | Stephen J. Chapman, „Electric Machinery Fundamentals“ 4 <sup>th</sup> edition, McGraw Hill Education Pvt. Ltd, 2010.  |         |           |
| 3.   | Deshpande M. V., Electrical Machines, Prentice Hall India, New Delhi, 2011.   |         |           |
| 4.   | J.B.Gupta, „Theory and performance of Electrical Machines“, S.K. Kataria and sons, 2002.  |         |           |
| 5.   | Irving L. Kosow 'Electric Machinery and Transformers' PHI, New Delhi, 1991.   |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1.   | <a href="http://www.nptelvideos.in/2012/11/electrical-machines-i.html">http://www.nptelvideos.in/2012/11/electrical-machines-i.html</a>   |         |           |
| 2.   | <a href="http://www.electrical4u.com/electrical-power-transformer-definition-and-types-of-transformer/">http://www.electrical4u.com/electrical-power-transformer-definition-and-types-of-transformer/</a> |         |           |
| 3.   | <a href="https://nptel.ac.in/courses/108102146/">https://nptel.ac.in/courses/108102146/</a>   |         |           |



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| Programme  | B.E/B.TECH   | Programme code   | Regulation |   |          |               | 2019 |       |  |
|--|--|------------------|------------|---|----------|---------------|------|-------|--|
| Department   | ELECTRICAL AND ELECTRONICS ENGINEERING               |                  |            |   | Semester |               |      | III   |  |
| Course code  | Course name  | Periods per week |            |   | Credit   | Maximum Marks |      |       |  |
|  |  | L                | T          | P | C        | CA            | ESE  | Total |  |
| U19TA302   | தமிழரும் தொழில்நுட்பமும்; /<br>TAMILS AND TECHNOLOGY | 2                | 0          | 0 | 1        | 40            | 60   | 100   |  |
| Content of the syllabus  |  |                  |            |   |          |               |      |       |  |
| அலகு 1   | நெசவு மற்றும் பானை தொழில்நுட்பம்                     |                  |            |   | Periods  | 3             |      |       |  |
| சங்ககாலத்தில் நெசவுத்தொழில் - பானை தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்   |  |                  |            |   |          |               |      |       |  |
| அலகு 2   | வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்            |                  |            |   | Periods  | 3             |      |       |  |
| சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றிய விவரங்கள் - மாமல்லபுர சிற்பங்களும், கோவில்களும் - சோழர் காலத்து பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் கால கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ -சாரோச்செனிக் கட்டிடக்கலை. |  |                  |            |   |          |               |      |       |  |
| அலகு 3   | உற்பத்தித் தொழில் நுட்பம்                            |                  |            |   | Periods  | 3             |      |       |  |
| கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல்- மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்  |  |                  |            |   |          |               |      |       |  |
| அலகு 4   | வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்         |                  |            |   | Periods  | 3             |      |       |  |
| அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித் தல் - பெருங்கடல் மற்றும் பண்டைய அறிவு - அறிவுசார் சமூகம்.  |  |                  |            |   |          |               |      |       |  |
| அலகு 5   | அறிவியல் தமிழ் மற்றும் கணித்தமிழ்                    |                  |            |   | Periods  | 3             |      |       |  |
| அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.  |  |                  |            |   |          |               |      |       |  |
|  |  |                  |            |   |          | Total Periods | 15   |       |  |

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|   |   |                  |   |            |                |               |     |       |
|---|---|------------------|---|------------|----------------|---------------|-----|-------|
| Programme   | B.E/B.TECH  | Programme code   |   | Regulation | 2019           |               |     |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>             |                  |   | Semester   | III            |               |     |       |
| Course code   | Course name   | Periods per week |   |            | Credit         | Maximum Marks |     |       |
|   |   | L                | T | P          | C              | CA            | ESE | Total |
| <b>U19TA302</b>   | <b>தமிழரும் தொழில்நுட்பமும்;; / TAMILS AND TECHNOLOGY</b> | 2                | 0 | 0          | 1              | 40            | 60  | 100   |
| <b>Content of the syllabus</b>  |   |                  |   |            |                |               |     |       |
| <b>UNIT I</b>   | <b>WEAVING AND CERAMIC TECHNOLOGY</b>                     |                  |   |            | <b>Periods</b> | <b>3</b>      |     |       |
| Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries  |   |                  |   |            |                |               |     |       |
| <b>UNIT II</b>  | <b>DESIGN AND CONSTRUCTION TECHNOLOGY</b>                 |                  |   |            | <b>Periods</b> | <b>3</b>      |     |       |
| Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period. |   |                  |   |            |                |               |     |       |
| <b>UNIT III</b>   | <b>MANUFACTURING TECHNOLOGY</b>                           |                  |   |            | <b>Periods</b> | <b>3</b>      |     |       |
| Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram   |   |                  |   |            |                |               |     |       |
| <b>UNIT IV</b>  | <b>AGRICULTURE AND IRRIGATION TECHNOLOGY</b>              |                  |   |            | <b>Periods</b> | <b>3</b>      |     |       |
| Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoempu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.   |   |                  |   |            |                |               |     |       |
| <b>UNIT V</b>   | <b>SCIENTIFIC TAMIL &amp; TAMIL COMPUTING</b>             |                  |   |            | <b>Periods</b> | <b>3</b>      |     |       |
| Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.   |   |                  |   |            |                |               |     |       |
| <b>Total Periods</b>  |   |                  |   |            |                | <b>15</b>     |     |       |

| <b>Text cum-Reference Books</b> |  |
|---------------------------------|--|
| 1                               | தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).   |
| 2                               | கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).   |
| 3                               | கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)   |
| 4                               | பொருதை -ஆற்றங்கரை நாகரிகம்.(தொல்லியல் துறை வெளியீடு)   |
| 5                               | Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL   |
| 6                               | Life of the Tamils- The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.  |
| 7                               | Historical Heritage of the Tamils (Dr.S.V.Subatamarnan, Dr.K.D.Thirunavukkarasu)(Published by:International Institute of Tamil Studies).   |
| 8                               | The Contributions of the Tamils to Indian Culture (Dr.M.Valarmath1)(Published by:International Institute of Tamil Studies.)  |
| 9                               | Keeladi- 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 10                              | Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)  |
| 11                              | Porumai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)   |
| 12                              | Journey of Civilization Indus to Vaigai (R.Balakrishnan)(Published by:RMRL)– Reference Book.   |



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|   |  |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
|---|--|------------------|------|------|------------|---------------|-------------|-----------------|-------|-------|-------|-------|-----------------------|-------|-------|-------|
| Programme   | <b>B.E.</b>  | Programme Code   |      |      | <b>102</b> | Regulation    | <b>2019</b> |                 |       |       |       |       |                       |       |       |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      | Semester   |               | <b>III</b>  |                 |       |       |       |       |                       |       |       |       |
| Course Code   | Course Name  | Periods Per Week |      |      | Credit     | Maximum Marks |             |                 |       |       |       |       |                       |       |       |       |
|   |  | L                | T    | P    |            | C             | CA          | ESE             | Total |       |       |       |                       |       |       |       |
| <b>U19EE308</b>   | <b>Analog and Digital Electronics Laboratory</b>   | 0                | 0    | 4    | 2          | 60            | 40          | 100             |       |       |       |       |                       |       |       |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>Analyze the basic characteristics of electronic devices such as diode, BJT, SCR.</li> <li>Analyze the oscillator, filter and Amplifier performance.</li> <li>Understand and analyze different applications of logic gates in digital circuits.</li> </ul> |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |      |      |            |               |             | Knowledge Level |       |       |       |       |                       |       |       |       |
|   | <b>CO1:</b> Choose the electronic device for specific application.   |                  |      |      |            |               |             | K3              |       |       |       |       |                       |       |       |       |
|   | <b>CO2:</b> Design the filter circuits for specific application.   |                  |      |      |            |               |             | K3              |       |       |       |       |                       |       |       |       |
|   | <b>CO3:</b> Choose the oscillator and amplifier for specific application.  |                  |      |      |            |               |             | K3              |       |       |       |       |                       |       |       |       |
|   | <b>CO4:</b> Verify the flip-flop and counter operation in digital circuits.  |                  |      |      |            |               |             | K4              |       |       |       |       |                       |       |       |       |
| <b>CO5:</b> Verify the multiplexer and encoder operation.               |  |                  |      |      |            |               | K2          |                 |       |       |       |       |                       |       |       |       |
| <b>Pre-requisites</b>   |  |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
| <b>CO / PO Mapping</b>  |  |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak |  |                  |      |      |            |               |             |                 |       |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
| Cos   | Programme Outcomes (Pos)   |                  |      |      |            |               |             |                 |       |       |       |       | PSOs                  |       |       |       |
|   | PO 1   | PO 2             | PO 3 | PO 4 | PO 5       | PO 6          | PO 7        | PO 8            | PO 9  | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| <b>CO 1</b>   | 3  | 2                | 2    |      | 1          | 1             |             |                 | 1     |       | 1     | 1     | 3                     | 2     |       |       |
| <b>CO 2</b>   | 3  | 2                | 2    |      | 1          | 1             |             |                 | 1     |       | 1     | 1     | 3                     | 2     |       |       |
| <b>CO 3</b>   | 3  | 2                | 2    |      | 1          | 1             |             |                 | 1     |       | 1     | 1     | 3                     | 2     |       |       |
| <b>CO 4</b>   | 3  | 2                | 2    |      | 1          | 1             |             |                 | 1     |       | 1     | 1     | 3                     | 2     |       |       |
| <b>CO 5</b>   | 3  | 2                | 2    |      | 1          | 1             |             |                 | 1     |       | 1     | 1     | 3                     | 2     |       |       |

**Course Assessment Methods****Direct**

1. Prelab and post labtest
2. Record mark
3. End-Semester examinations

**Indirect**

1. Course - end survey

**Content of the syllabus**

| S.No | LIST OF EXPERIMENTS   | Course Outcome | Program Outcome & Program Specific Outcome |
|------|---|----------------|--|
| 1.   | To learn the characteristics of basic electronic devices such as Diode, BJT,SCR.          | CO1            | PO1,PO2, PO9, PSO1                         |
| 2.   | Frequency Response of CE Amplifier.   | CO2            | PO1,PO2, PO4,PO9,PSO1                      |
| 3.   | Measurement of H-Parameters of CSFET Configuration  | CO1, CO2       | PO1,PO2, PO9,PSO1                          |
| 4.   | Bridge Rectifier with and Without Filter.   | CO1            | PO1,PO2, PO9,PSO1                          |
| 5.   | Study of RC Phase Shift Oscillator.   | CO3            | PO1,PO2, PO9,PSO1                          |
| 6.   | Implementation of the given Boolean function using logic gates in both SOP and POS forms. | CO4            | PO1,PO2, PO9,PSO1                          |
| 7.   | Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.        | CO4            | PO1,PO2, PO9,PSO1                          |
| 8.   | Design and verify the 4-bit synchronous counter   | CO4            | PO1,PO2, PO9,PSO1                          |
| 9.   | Design and verify the 4-bit asynchronous counter  | CO4            | PO1,PO2, PO9,PSO1                          |
| 10.  | Implementation and verification of decoder/de-multiplexer and encoder using logic gates   | CO5            | PO1,PO2,PO3 PO9,PSO1                       |



**Total Periods****60**



|  |  |                  |     |        |     |               |                 |            |             |      |      |      |                      |      |      |      |
|--|--|------------------|-----|--------|-----|---------------|-----------------|------------|-------------|------|------|------|----------------------|------|------|------|
| Programme  | <b>B.E.</b>  | Programme Code   |     |        |     | <b>102</b>    | Regulation      |            | <b>2019</b> |      |      |      |                      |      |      |      |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |     |        |     |               | Semester        | <b>III</b> |             |      |      |      |                      |      |      |      |
| Course Code  | Course Name  | Periods Per Week |     | Credit |     | Maximum Marks |                 |            |             |      |      |      |                      |      |      |      |
|  |  | L                | T   | P      | C   | CA            | ESE             | Total      |             |      |      |      |                      |      |      |      |
| <b>U19EE309</b>  | <b>DC Machines and Transformers Laboratory</b>   | 0                | 0   | 4      | 2   | 60            | 40              | 100        |             |      |      |      |                      |      |      |      |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Expose the operation of D.C. machines and transformers and give them experimental skill.</li> <li>Insight into the constructional details of the dc machines and transformers with a view of better understanding of their working principles.</li> <li>Evaluate the performance of various dc machines and single-phase transformers by conducting appropriate experiments.</li> </ul> |                  |     |        |     |               |                 |            |             |      |      |      |                      |      |      |      |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |     |        |     |               | Knowledge level |            |             |      |      |      |                      |      |      |      |
|  | <b>CO1:</b> Interpret the constructional details of the DC machines and Transformers and also understand the significance of different connections of three phase transformers   |                  |     |        |     |               | K2              |            |             |      |      |      |                      |      |      |      |
|  | <b>CO2:</b> Estimate or test the performance of any DC machine (shunt, series or compound) and single-phase transformer, by conducting suitable experiments and report the results.  |                  |     |        |     |               | K2              |            |             |      |      |      |                      |      |      |      |
|  | <b>CO3:</b> Analyze the various speed control and braking techniques for dc motors   |                  |     |        |     |               | K2              |            |             |      |      |      |                      |      |      |      |
|  | <b>CO4:</b> Develop simulation models and prototype modules in view of implementing any control technique upon dc motors and single-phase transformers for various applications  |                  |     |        |     |               | K2              |            |             |      |      |      |                      |      |      |      |
| <b>CO5:</b> Connect single phase transformers for three phase operation and phase conversion |  |                  |     |        |     | K2            |                 |            |             |      |      |      |                      |      |      |      |
| <b>Pre-requisites</b>  | -  |                  |     |        |     |               |                 |            |             |      |      |      |                      |      |      |      |
| <b>CO/PO Mapping</b><br>(3/2/1 indicates strength of correlation)3-Strong,2-Medium,1-Week    |  |                  |     |        |     |               |                 |            |             |      |      |      | <b>CO/PO Mapping</b> |      |      |      |
| <b>COs</b>   | Programmeoutcomes(POs)   |                  |     |        |     |               |                 |            |             |      |      |      | <b>PSO s</b>         |      |      |      |
|  | PO1  | PO2              | PO3 | PO4    | PO5 | PO6           | PO7             | PO8        | PO9         | PO10 | PO11 | PO12 | PSO1                 | POS2 | POS3 | POS4 |
| <b>CO1</b>   | 3  | 2                | 3   | -      | 1   | 2             | -               | -          | 2           | 1    | 2    | 2    | 2                    | 1    | 1    | -    |
| <b>CO2</b>   | 3  | 2                | 3   | 1      | 1   | -             | -               | -          | 1           | -    | 2    | 1    | 1                    | 1    | 2    | -    |
| <b>CO3</b>   | 3  | 2                | 3   | -      | 1   | 2             | 1               | -          | 2           | -    | 1    | 2    | 1                    | 1    | 2    | -    |
| <b>CO4</b>   | 3  | 3                | 3   | 1      | 1   | -             | -               | -          | 2           | -    | 1    | 1    | 2                    | 1    | 1    | -    |
| <b>CO5</b>   | 3  | 3                | 3   | 2      | 2   | 1             | -               | -          | 1           | 2    | 1    | 2    | 1                    | 1    | 1    | -    |



| <b>Course Assessment Methods</b>   |   |                       |   |
|--|---|-----------------------|---|
| <b>Direct</b>  |   |                       |   |
| 1. Prelab and post labtest<br>2. Record mark<br>3. End-Semester examinations |   |                       |   |
| <b>Indirect</b>  |   |                       |   |
| 1. Course - end survey   |   |                       |   |
| <b>Content of the syllabus</b>   |   |                       |   |
| <b>S.No</b>  | <b>LIST OF EXPERIMENTS</b>  | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
| 1.   | Open circuit and load characteristics of separately and self excited DC shunt generators.   | CO2                   | PO1,PO2,PO9, PSO1                                     |
| 2.   | Load characteristics of DC compound generator with differential and cumulative connection.  | CO2                   | PO1,PO2,PO9, PSO1                                     |
| 3.   | Load characteristics of DC shunt and compound motor.  | CO2                   | PO1,PO2,PO9, PSO1                                     |
| 4.   | Load characteristics of DC series motor.  | CO2                   | PO1,PO2,PO9, PSO1                                     |
| 5.   | Swinburne's test and speed control of DC shunt motor  | CO3                   | PO1,PO2,PO9, PSO1                                     |
| 6.   | Hopkinson's test on DC motor – generator set.   | CO4                   | PO1,PO2,PO9, PSO1                                     |
| 7.   | Load test on single-phase transformer and three phase transformer connections.  | CO1                   | PO1,PO2,PO9, PSO1                                     |
| 8.   | Open circuit and short circuit tests on single phase Transformer.   | CO1                   | PO1,PO2,PO9, PSO1                                     |
| 9.   | Sumpner's test on transformers  | CO5                   | PO1,PO2,PO9, PSO1                                     |
| 10.  | Separation of no-load losses in single phase transformer.   | CO5                   | PO1,PO2,PO9, PSO1                                     |
|  |   |                       | <b>Total Periods   60</b>                             |
| <b>Lab Manual</b>  |   |                       |   |
| 1.   | DEPARTMENT OF EEE Aurora's Technological and Research Institute Parvathapur, Uppal, Hyderabad   |                       |   |
| 2.   | Annauniversity-EEE-SEM-ElectricalMachines-Laboratory  |                       |   |
| <b>E-Resources</b>   |   |                       |   |
| 1.   | <a href="https://studentsfocus.com/notes/anna_university/EEE/4SEM/EE6411-Electrical%20Machines-I%20Laboratory.pdf">https://studentsfocus.com/notes/anna_university/EEE/4SEM/EE6411-Electrical%20Machines-I%20Laboratory.pdf</a> |                       |   |

|   |   |             |                |     |     |                  |            |            |            |               |   |                       |       |      |      |      |
|---|---|-------------|----------------|-----|-----|------------------|------------|------------|------------|---------------|---|-----------------------|-------|------|------|------|
|          | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode-637 205   |             |                |     |     |                  |            |            |            |               |  |                       |       |      |      |      |
|   | Programme   | <b>B.E.</b> | Programme Code |     |     |                  | <b>102</b> | Regulation |            |               | <b>2019</b>   |                       |       |      |      |      |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |             |                |     |     |                  | Semester   |            | <b>III</b> |               |   |                       |       |      |      |      |
| Course Code   | Course Name   |             |                |     |     | Periods Per Week |            |            | Credit     | Maximum Marks |   |                       |       |      |      |      |
|   |   |             |                |     |     | L                | T          | P          |            | C             | CA  | ESE                   | Total |      |      |      |
| <b>U19MCSY3</b>   | <b>NUMERICALABILITY</b>   |             |                |     |     | 3                | 0          | 0          | 0          | 100           | -   | 100                   |       |      |      |      |
| <b>Course Objective</b>   | The main objective of the course is to: <ul style="list-style-type: none"> <li>• Develop skill to meet the competitive examinations for better job opportunity</li> <li>• Accommodate fundamental, mathematical aspects to instill confidence among students</li> <li>• Expand their knowledge and to develop their logical reasoning thinking ability</li> </ul> |             |                |     |     |                  |            |            |            |               |   |                       |       |      |      |      |
| <b>Course Outcome</b>   | At the end of the course, the student will be able to:  |             |                |     |     |                  |            |            |            |               | KL  |                       |       |      |      |      |
|   | <b>CO1:</b> Develop a proper understanding of the number system   |             |                |     |     |                  |            |            |            |               | K3  |                       |       |      |      |      |
|   | <b>CO2:</b> Explain the meaning of ratio, proportion and percentage   |             |                |     |     |                  |            |            |            |               | K2  |                       |       |      |      |      |
|   | <b>CO3:</b> Solve complex problems involving speed, distance and time.  |             |                |     |     |                  |            |            |            |               | K3  |                       |       |      |      |      |
|   | <b>CO4:</b> Understand the relationship between compound interest and its influencing factors   |             |                |     |     |                  |            |            |            |               | K2  |                       |       |      |      |      |
| <b>CO5:</b> Solve surface area and volume of rectangular-prism problems with real objects |   |             |                |     |     |                  |            |            |            | K3            |   |                       |       |      |      |      |
| <b>Pre-requisites</b>   | -   |             |                |     |     |                  |            |            |            |               |   |                       |       |      |      |      |
| <b>CO/PO Mapping</b>  |   |             |                |     |     |                  |            |            |            |               |   | <b>CO/PSO Mapping</b> |       |      |      |      |
| (3/2/1indicatesstrength of correlation)3-Strong,2- Medium,1-Weak                          |   |             |                |     |     |                  |            |            |            |               |   |                       |       |      |      |      |
| COs   | Programme Outcomes(POs)   |             |                |     |     |                  |            |            |            |               |   | PSOs                  |       |      |      |      |
|   | PO1   | PO2         | PO3            | PO4 | PO5 | PO6              | PO7        | PO8        | PO9        | PO10          | PO11  | PO12                  | PSO1  | PSO2 | PSO3 | PSO4 |
| CO 1  | 3   | 3           |                |     |     |                  |            |            |            |               |   |                       | 2     |      |      |      |
| CO 2  | 3   | 3           |                |     |     |                  |            |            |            |               |   |                       | 2     |      |      |      |
| CO 3  | 3   | 3           |                |     |     |                  |            |            |            |               |   |                       | 2     |      |      |      |
| CO 4  | 3   | 3           |                |     |     |                  |            |            |            |               |   |                       | 2     |      |      |      |
| CO 5  | 3   | 3           |                |     |     |                  |            |            |            |               |   |                       | 2     |      |      |      |

| <b>Content of the syllabus</b>  |  |         |           |
|---|--|---------|-----------|
| <b>Unit-I</b>   | <b>NUMBERSYSTEMS</b>   | Periods | <b>6</b>  |
| Number Properties–HCF–LCM–Square root–Cube root –Simplification –Averages.                  |  |         |           |
| <b>Unit-II</b>  | <b>DIRECTPROPORTIONALPROBLEMS</b>  | Periods | <b>8</b>  |
| Percentage-Profit & Loss–.Ratio &Proportions–Mixture& Allegations-Problem on Ages           |  |         |           |
| <b>Unit-III</b>   | <b>INDIRECTPROPORTIONALPROBLEMS</b>  | Periods | <b>8</b>  |
| Time & Work–Pipes & Cisterns-Time,Speed & Distance–Boats & Streams–Races & Games of Skills. |  |         |           |
| <b>Unit-IV</b>  | <b>BANKER’SPROBLEMS</b>  | Periods | <b>4</b>  |
| Simple Interest –Compound Interest – Logarithms–Partnership-Discounts.                      |  |         |           |
| <b>Unit-V</b>   | <b>MISCELLANEOUSPROBLEMS</b>   | Periods | <b>4</b>  |
| Mensuration : Area & perimeter –Volume & Surface Area–Geometry-Trigonometry.                |  |         |           |
| <b>Total Periods</b>  |  |         | <b>30</b> |
| <b>Text Books</b>   |  |         |           |
| 1.  | DineshKhattar-The Pearson guide to Quantitative Aptitude for Competitive Examinations 3 <sup>rd</sup> edition. |         |           |
| <b>References</b>   |  |         |           |
| 1.  | R.S.Aggarwal –Quantitative Aptitudefor Competitive Examinations  |         |           |



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|  |   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
|--|---|------------------|------------|------------|-------------|---------------|-----------------|-------|------|-------|-------|-------|-----------------------|-------|-------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |       |      |       |       |       |                       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>IV</b>   |               |                 |       |      |       |       |       |                       |       |       |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |                 |       |      |       |       |       |                       |       |       |
|  |   | L                | T          | P          | C           | CA            | ESE             | Total |      |       |       |       |                       |       |       |
| <b>U19MA406</b>  | <b>Numerical Methods</b>  | 3                | 1          | 0          | 4           | 40            | 60              | 100   |      |       |       |       |                       |       |       |
| <b>Course Objective</b>  | The main Objective of the course is to <ul style="list-style-type: none"> <li>• Understand appropriate numerical methods to approximate function</li> <li>• Recognize appropriate numerical methods to solve a differential function</li> <li>• Provide information about appropriate numerical methods to evaluate a derivative at a value</li> <li>• Introduce appropriate numerical methods to calculate a definite integral</li> <li>• Proficiently understand boundary value problems</li> </ul> |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |            |            |             |               | Knowledge level |       |      |       |       |       |                       |       |       |
|  | <b>CO1:</b> Apply numerical methods to obtain approximate solutions to mathematical problems  |                  |            |            |             |               | K3,K5           |       |      |       |       |       |                       |       |       |
|  | <b>CO2:</b> Derive numerical methods for various mathematical operations and tasks such as interpolation, differentiation , integration and perform an error analysis   |                  |            |            |             |               | K1,K3           |       |      |       |       |       |                       |       |       |
|  | <b>CO3:</b> Analyze and evaluate the accuracy of common numerical integral methods  |                  |            |            |             |               | K2,K5           |       |      |       |       |       |                       |       |       |
|  | <b>CO4:</b> Determine Solutions of Differential Equations using an appropriate numerical methods  |                  |            |            |             |               | K3,K4           |       |      |       |       |       |                       |       |       |
| <b>CO5:</b> Design boundary value problems.  |   |                  |            |            |             | K3,K4         |                 |       |      |       |       |       |                       |       |       |
| <b>Pre-requisites</b>  | -   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |   |                  |            |            |             |               |                 |       |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |
| <b>COs</b>   | Programme Outcomes (POs)  |                  |            |            |             |               |                 |       |      |       |       |       | PSOs                  |       |       |
|  | PO 1  | PO 2             | PO 3       | PO 4       | PO 5        | PO 6          | PO 7            | PO 8  | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 |
| <b>CO 1</b>  | 3   | 3                |            |            |             |               |                 |       |      |       |       |       | 2                     |       |       |
| <b>CO 2</b>  | 3   | 3                |            |            | 2           |               |                 |       |      |       |       |       | 2                     |       |       |
| <b>CO 3</b>  | 3   | 3                |            |            |             |               |                 |       |      |       |       |       | 2                     |       |       |
| <b>CO 4</b>  | 3   | 3                |            |            |             |               |                 |       |      |       |       |       | 2                     |       |       |
| <b>CO 5</b>  | 3   | 3                |            |            | 2           |               |                 |       |      |       |       |       | 2                     |       |       |
| <b>Course Assessment Methods</b>   |   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
| <b>Direct</b>  |   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp;III</li> <li>2. Assignment: Simulation using tool</li> <li>3. End-Semester examinations</li> </ol> |   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
| <b>Indirect</b>  |   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |
| <ol style="list-style-type: none"> <li>1. Course – end survey</li> </ol>   |   |                  |            |            |             |               |                 |       |      |       |       |       |                       |       |       |

| <b>Content Of the Syllabus</b>   |  |         |           |
|--|--|---------|-----------|
| <b>Unit – I</b>  | <b>SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS</b>   | Periods | <b>12</b> |
| Solution of equation – Fixed point iteration: $x=g(x)$ method – Newton's method – Solution of linear system by Gauss-Jordan method - Iterative method – Gauss Jacobi and Seidel methods – Inverse of a matrix by Gauss Jordan method – Eigen values of a matrix by power method and by Jacobi method for symmetric matrix. |  |         |           |
| <b>Unit - II</b>   | <b>INTERPOLATION AND APPROXIMATION</b>   | Periods | <b>12</b> |
| Lagrangian Interpolation – Divided differences – Newton's divided difference formula - Interpolating with a cubic spline – Newton's forward and backward difference formula  |  |         |           |
| <b>Unit – III</b>  | <b>NUMERICAL DIFFERENTIATION AND INTEGRATION</b>   | Periods | <b>12</b> |
| Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integral using trapezoidal and Simpson's rules  |  |         |           |
| <b>Unit - IV</b>   | <b>INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS</b>  | Periods | <b>12</b> |
| Single step methods: Taylor series method – Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multi step methods: Milne's and Adam's predictor and corrector methods  |  |         |           |
| <b>Unit – V</b>  | <b>BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS</b>  | Periods | <b>12</b> |
| Finite difference solution of second order ordinary differential equations – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.   |  |         |           |
| <b>Total Periods</b>   |  |         | <b>60</b> |
| <b>Text Books</b>  |  |         |           |
| 1  | Veerarjan.T and Ramachandran.T, Numerical methods with programming in C, Second Edition, Tata McGraw-Hill Publishing. Co. Ltd, 2007. |         |           |
| 2  | Grewal.B.S and Grewal.J.S, Numerical methods in Engineering and Science, Sixth Edition, Khanna Publishers, New Delhi, 2004           |         |           |
| <b>References</b>  |  |         |           |
| 1.   | Gerald.C.F and Wheatley.P.O, Applied Numerical Analysis, 7th Edition, Pearson Education Asia, New Delhi, 2009.                       |         |           |
| 2.   | Sankara Rao K, Numerical Methods for Scientists and Engineers, Third Edition, Prentice Hall of India Private Ltd, New Delhi, 2012.   |         |           |
| 3.   | Burden R, L. and Faires J.D., Numerical Analysis, Cengage Learning, 10 <sup>th</sup> Edition, 2015.                                  |         |           |
| 4.   | M.K.Jain, Numerical Methods for Scientific and Engineering Computations, New Age Publishers  |         |           |
| 5.   | Steven C.Chara Raymond P.Canale, “ Numerical Methods for Engineering”, Tata McGraw Hill Publishers, rd Edition, 2000.                |         |           |
| <b>E-Resources</b>   |  |         |           |
| 1  | <a href="https://www.academia.edu">https://www.academia.edu</a> > Numerical_Methods_for_Engineers.                                   |         |           |
| 2  | <a href="http://www.learnerstv.com/Free-engineering-Video-lectures">www.learnerstv.com/Free-engineering-Video-lectures</a>           |         |           |
| 3  | <a href="http://www.nptel.ac.in">www.nptel.ac.in</a>   |         |           |



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|--|--|------------------|------|------|------------|---------------|-------------|------------------------|------|-------|-------|-------|-----------------------|------|-------|-------|
| Programme  | <b>B.E.</b>  | Programme Code   |      |      | <b>102</b> | Regulation    | <b>2019</b> |                        |      |       |       |       |                       |      |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      | Semester   |               | <b>IV</b>   |                        |      |       |       |       |                       |      |       |       |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit     | Maximum Marks |             |                        |      |       |       |       |                       |      |       |       |
|  |  | L                | T    | P    | C          | CA            | ESE         | Total                  |      |       |       |       |                       |      |       |       |
| <b>U19EE410</b>  | <b>Linear Integrated Circuits</b>  | 3                | 0    | 0    | 3          | 40            | 60          | 100                    |      |       |       |       |                       |      |       |       |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Learn the characteristics of operational amplifiers</li> <li>Understand the applications of operational amplifiers,</li> <li>Understand the concept of timers and voltage regulators</li> <li>Analyze the function of special IC's</li> </ul> |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |      |      |            |               |             | <b>Knowledge Level</b> |      |       |       |       |                       |      |       |       |
|  | <b>CO1:</b> Describe the various ideal and practical characteristics of an OPAMP   |                  |      |      |            |               |             | K2                     |      |       |       |       |                       |      |       |       |
|  | <b>CO2:</b> Develop simple OPAMP based circuits  |                  |      |      |            |               |             | K4                     |      |       |       |       |                       |      |       |       |
|  | <b>CO3:</b> Implement various signal generating circuits.  |                  |      |      |            |               |             | K3                     |      |       |       |       |                       |      |       |       |
|  | <b>CO4:</b> Analyze and design various types of ADCs and DACs  |                  |      |      |            |               |             | K3                     |      |       |       |       |                       |      |       |       |
|  | <b>CO5:</b> Analyze and construct various application circuits using 555 timers.   |                  |      |      |            |               |             | K3                     |      |       |       |       |                       |      |       |       |
| <b>Pre-requisites</b>  | U19EE303- Analog Electronics   |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                  |      |      |            |               |             |                        |      |       |       |       | <b>CO/PSO Mapping</b> |      |       |       |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |      |      |            |               |             |                        |      |       |       |       | PSOs                  |      |       |       |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5       | PO 6          | PO 7        | PO 8                   | PO 9 | PO 10 | PO 11 | PO 12 | PSO1                  | PSO2 | PSO 3 | PSO 4 |
| CO 1   | 3  |                  |      |      |            |               |             |                        |      |       |       | 3     | 2                     |      |       |       |
| CO 2   | 3  | 2                |      |      | 2          |               |             |                        |      |       |       | 3     | 3                     | 2    | 3     |       |
| CO 3   | 2  | 2                | 1    |      | 2          |               |             |                        |      |       |       | 3     | 3                     | 2    | 3     |       |
| CO 4   | 2  |                  | 2    |      |            |               |             |                        |      |       |       | 3     | 3                     |      |       |       |
| CO 5   | 1  | 2                | 2    |      |            |               |             |                        |      |       |       | 3     | 2                     |      |       | 3     |
| <b>Course Assessment Methods</b>   |  |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |
| <b>Direct</b>  |  |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |
| 1. Continuous Assessment Test I, II &III<br>2. Assignment<br>3. End-Semester examinations          |  |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |
| <b>Indirect</b>  |  |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |
| 1. Course - end survey   |  |                  |      |      |            |               |             |                        |      |       |       |       |                       |      |       |       |

| <b>Content of the Syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>OPERATIONAL AMPLIFIER CHARACTERISTICS</b>  | Periods | <b>9</b>  |
| Functional Block Diagram – Symbol, Characteristics of an ideal operational amplifier, transfer characteristics, Circuit schematic of $\mu A$ 741, Open loop gain, CMRR-input bias and offset currents, input and output offset voltages, offset compensation techniques. Frequency response, characteristics – stability, limitations, frequency compensation, slew rate. Transfer characteristics.   |   |         |           |
| <b>Unit - II</b>  | <b>LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS</b>  | Periods | <b>9</b>  |
| Inverting and Non-inverting amplifiers – Voltage follower, Summing amplifier, Differential amplifier, Instrumentation amplifier. Integrator and Differentiator – Practical considerations. Voltage to Current and Current to Voltage converters, Phase changers.  |   |         |           |
| <b>Unit - III</b>   | <b>NON-LINEAR APPLICATIONS OF OPAMP AND SINGLE POWER SUPPLY OPAMPS</b>  | Periods | <b>9</b>  |
| Comparator – Regenerative comparator, Zero crossing detector, Window detector, Sample and hold circuit, Precision diode, Half and Full wave rectifiers, Active peak detector, Clipper and Clamper, Need for single power supply operational amplifiers – LM324, AC Inverting and Non-Inverting amplifiers   |   |         |           |
| <b>Unit - IV</b>  | <b>VOLTAGE REGULATORS &amp; A-D and D-A CONVERTERS</b>  | Periods | <b>9</b>  |
| IC VOLTAGE REGULATORS: Block diagram of 723 general purpose voltage regulator – Circuit configurations, Current limiting schemes, Output current boosting, Fixed and adjustable three terminal regulators, Switching regulators. A-D and D-A CONVERTERS: DAC/ADC performance characteristics – Digital to Analog Converters: Binary weighted and R-2R Ladder types – Analog to digital converters: Continuous, Counter ramp, Successive approximation, Single slope, Dual slope and Flash Type. |   |         |           |
| <b>Unit - V</b>   | <b>SPECIAL FUNCTION ICs</b>   | Periods | <b>9</b>  |
| 555 Timer Functional block diagram and description – Monostable and Astable operation, Applications, 566 Voltage Controlled Oscillator, Analog Multiplier, Comparator ICs. PLL Functional Block diagram – Principle of operation, Building blocks of PLL, Characteristics, Derivations of expressions for Lock and Capture ranges, Applications: AM and FM detection, Motor speed control.  |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | Adel Sedra, Kenneth.C Smith, —Microelectronic Circuits, Oxford University Press,New Delhi,2010.   |         |           |
| 2.  | Roy Choudhury and Shail Jain, „Linear Integrated Circuits“, 4th Edition, New Age International Publishers,2010  |         |           |
| <b>References</b>   |   |         |           |
| 1.  | Michael Jacob J, —Applications and Design with Analog Integrated Circuits, Prentice Hall of India, New Delhi, 2010.   |         |           |
| 2.  | Gayakwad A R, OP-Amps and Linear Integrated circuits, Prentice Hall India, New Delhi, 2010  |         |           |
| 3.  | CoughlinFR,andDriscollFF,—OperationalAmplifiersandLinearIntegratedCircuits,PrenticeHalof India, New Delhi,2010  |         |           |
| 4.  | SergioFranco,“DesignwithoperationalamplifiersandAnalogIntegratedcircuits“,TataMcGrawHill,3 <sup>rd</sup> Edition, 2002.   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | <a href="https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.htm">https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.htm</a> |         |           |
| 2.  | <a href="https://www.eeguide.com/linear-integrated-circuits-and-applications/">https://www.eeguide.com/linear-integrated-circuits-and-applications/</a>                         |         |           |
| 3.  | <a href="https://www.electrical4u.com">https://www.electrical4u.com</a>   |         |           |



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|   |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
|---|--|-------------------------|------------|-------------------|----------------|----------------------|------------|------------------------|------------|-------------|-------------|------------------------|-------------|-------------|-------------|-------------|
| <b>Programme</b>  | <b>B.E.</b>  | <b>Programme Code</b>   | <b>102</b> | <b>Regulation</b> | <b>2019</b>    |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>Department</b>   | <b>ELECTRICAL AND ELECTRONICSENGINEERING</b>   |                         |            | <b>Semester</b>   | <b>IV</b>      |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>Course Code</b>  | <b>Course Name</b>   | <b>Periods Per Week</b> |            |                   | <b>Credits</b> | <b>Maximum Marks</b> |            |                        |            |             |             |                        |             |             |             |             |
|   |  | <b>L</b>                | <b>T</b>   | <b>P</b>          | <b>C</b>       | <b>CA</b>            | <b>ESE</b> | <b>TOTAL</b>           |            |             |             |                        |             |             |             |             |
| <b>U19EE411</b>   | <b>AC Machines</b>   | 3                       | 0          | 0                 | 3              | 40                   | 60         | 100                    |            |             |             |                        |             |             |             |             |
| <b>Course Objectives</b>  | The students should made to <ul style="list-style-type: none"> <li>Learn the Construction and performance of salient and non – salient type synchronous generators and motors.</li> <li>Learn the Construction, principle of operation and performance of induction machines.</li> <li>Learn the Construction, principle of operation and performance of single-phase induction motors and special machines.</li> <li>Analyze the Starting and speed control of three-phase induction motors.</li> <li>Analyze the efficiency of the AC machines.</li> </ul> |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                         |            |                   |                |                      |            | <b>Knowledge Level</b> |            |             |             |                        |             |             |             |             |
|   | <b>CO1:</b> Acquire knowledge about the constructional details and principle of operation of alternators.  |                         |            |                   |                |                      |            | K3                     |            |             |             |                        |             |             |             |             |
|   | <b>CO2:</b> Analyze the performance characteristics of synchronous motor   |                         |            |                   |                |                      |            | K4                     |            |             |             |                        |             |             |             |             |
|   | <b>CO3:</b> Acquire knowledge on Construction, principle of operation and performance of induction machines.   |                         |            |                   |                |                      |            | K3                     |            |             |             |                        |             |             |             |             |
|   | <b>CO4:</b> Acquire knowledge about Starting and speed control of three Phase induction motors   |                         |            |                   |                |                      |            | K3                     |            |             |             |                        |             |             |             |             |
| <b>Prerequisites</b>  | <b>CO5:</b> Acquire knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.   |                         |            |                   |                |                      |            | K3                     |            |             |             |                        |             |             |             |             |
|   | U19EE307- DC Machines and Transformers   |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>CO / PO Mapping</b>  |  |                         |            |                   |                |                      |            |                        |            |             |             | <b>CO/ PSO Mapping</b> |             |             |             |             |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak                  |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>COs</b>  | <b>Programme Outcomes (POs)</b>  |                         |            |                   |                |                      |            |                        |            |             |             |                        | <b>PSOs</b> |             |             |             |
|   | <b>PO1</b>   | <b>PO2</b>              | <b>PO3</b> | <b>PO4</b>        | <b>PO5</b>     | <b>PO6</b>           | <b>PO7</b> | <b>PO8</b>             | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b>            | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> |
| <b>CO1</b>  | 3  | 3                       | 2          | 1                 | 2              | 3                    | 2          | -                      | -          | -           | -           | 2                      | 3           | -           | 3           | 2           |
| <b>CO2</b>  | 3  | 2                       | 2          | 1                 | 1              | 3                    | 2          | -                      | -          | -           | -           | 2                      | 3           | -           | 2           | 2           |
| <b>CO3</b>  | 3  | 2                       | 2          | 1                 | 1              | 2                    | 1          | -                      | -          | -           | -           | 2                      | 3           | -           | 2           | 2           |
| <b>CO4</b>  | 3  | 2                       | 2          | 1                 | 1              | 2                    | 2          | -                      | -          | -           | -           | 2                      | 2           | -           | 3           | 1           |
| <b>CO5</b>  | 3  | 2                       | 2          | 1                 | 2              | 1                    | 2          | -                      | -          | -           | -           | 2                      | 3           | -           | 2           | 2           |
| <b>Course Assessment methods</b>  |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>Direct</b>   |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| 1. Continuous Assessment Test I, II&III<br>2. Assignment.<br>3. End-Semester examinations |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| <b>Indirect</b>   |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |
| 1. Course – End Survey.   |  |                         |            |                   |                |                      |            |                        |            |             |             |                        |             |             |             |             |



| <b>Content of the syllabus.</b>  |   |         |          |
|--|---|---------|----------|
| <b>Unit - I</b>  | <b>ALTERNATOR</b>   | Periods | <b>9</b> |
| Constructional Details – Types of Rotors – EMF Equation – Synchronous Reactance – Armature Reaction – Voltage Regulation – EMF, MMF and ZPF Methods – Synchronizing and Parallel Operation – Synchronizing Power - Power Output Equations - Change of Excitation and Mechanical Input.                                 |   |         |          |
| <b>Unit - II</b>   | <b>SYNCHRONOUS MOTOR</b>  | Periods | <b>9</b> |
| Principle of Operation – Torque Equation – Starting Methods -Operation on Infinite Busbars – V and Inverted V Curves – Input and Output Power Equations – Power/Power Angle Relations – Hunting - Synchronous Condenser - Applications.  |   |         |          |
| <b>Unit - III</b>  | <b>THREE PHASE INDUCTION MOTOR</b>  | Periods | <b>9</b> |
| Constructional Details – Types of Rotors – Squirrel Cage and Slip Ring – Principle of Operation-Slip-Torque Characteristics – Losses and Efficiency – Load Test - No Load and Blocked Rotor Tests - Equivalent Circuit-Separation of No Load Losses – Crawling and Cogging – Double Cage Rotors – Induction Generator. |   |         |          |
| <b>Unit - IV</b>   | <b>STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR</b>  | Periods | <b>9</b> |
| Need for Starters – Types of Starters – Stator Resistance, Rotor Resistance, Autotransformer, Star-Delta Starters and DOL Starters - Speed Control by Varying Voltage, Frequency, Poles and Rotor Resistance – Slip Power Recovery Scheme.   |   |         |          |
| <b>Unit - V</b>  | <b>SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES</b>   | Period  | <b>9</b> |
| Constructional Details – Double Revolving Field Theory – Equivalent Circuit – Starting Methods – Types of single phase induction motors-Applications- <b>Special machines:</b> Servo Motor, Stepper Motor and Universal Motor and Switched Reluctance Motor and Linear Induction Motor.                                |   |         |          |
| Total Periods  |   |         | 45       |
| <b>Text Books</b>  |   |         |          |
| 1.   | Dr. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 7 <sup>th</sup> edition, 2011.  |         |          |
| 2.   | Nagrath, I.J. and Kothari, D.P., “Electrical Machines”, Tata McGraw Hill Education Private Limited Publishing Company Ltd., 4th Edition, 2010   |         |          |
| 3.   | Rajput R.K., —Electrical Machines, 5th Edition, Laxmi Publications, New Delhi, 2008.  |         |          |
| 4.   | Gupta J.B., —Electrical Machines (AC & DC Machines), 4th Edition, SK Kataria & Sons, New Delhi, 2012.   |         |          |
| <b>References</b>  |   |         |          |
| 1.   | A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, “Electric Machinery”, 7 <sup>th</sup> Edition, Tata McGraw Hill, 2013, New Delhi.  |         |          |
| 2.   | Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff: “Analysis of Electric Machinery & Drive systems” - IEEE Press, 2002.  |         |          |
| 3.   | Jingde Gao, Xiangheng Wang, AC Machine Systems: Mathematical Model and Parameters, Analysis, and System Performance, Springer, 2011   |         |          |
| 4.   | EG. Janardanan, Special Electrical Machines, PHI Learning PVT LTD., (2014)  |         |          |
| 5.   | M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.  |         |          |
| <b>E-Resources</b>   |   |         |          |
| 1.   | <a href="https://nptel.ac.in/courses/108105131/#">https://nptel.ac.in/courses/108105131/#</a>   |         |          |
| 2.   | <a href="https://www.electrical4u.com/electrical-engineering-articles/electric-motor/">https://www.electrical4u.com/electrical-engineering-articles/electric-motor/</a>   |         |          |
| 3.   | <a href="https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-685-electric-machines-fall-2013/">https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-685-electric-machines-fall-2013/</a> |         |          |



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|   |   |                  |   |   |            |               |             |                 |  |
|---|---|------------------|---|---|------------|---------------|-------------|-----------------|--|
| Programme   | <b>B.E.</b>   | Programme Code   |   |   | <b>102</b> | Regulation    | <b>2019</b> |                 |  |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |   |   | Semester   |               | <b>IV</b>   |                 |  |
| Course Code   | Course Name   | Periods Per Week |   |   | Credit     | Maximum Marks |             |                 |  |
|   |   | L                | T | P | C          | CA            | ESE         | Total           |  |
| <b>U19EE412</b>   | <b>Transmission and Distribution of Electrical Energy</b>   | 3                | 0 | 0 | 3          | 40            | 60          | 100             |  |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• understand the importance and the functioning of transmission line parameters.</li> <li>• Obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.</li> <li>• Understand the concepts of Lines and Insulators.</li> <li>• Understand the mechanical design of transmission lines.</li> <li>• Understand the Structure and distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.</li> </ul> |                  |   |   |            |               |             |                 |  |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |   |   |            |               |             | Knowledge Level |  |
|   | <b>CO1:</b> Develop expressions for the computation of transmission line parameters.  |                  |   |   |            |               |             | K2              |  |
|   | <b>CO2:</b> Acquire knowledge on the performance of Transmission lines.   |                  |   |   |            |               |             | K4              |  |
|   | <b>CO3:</b> Analyze the voltage distribution in insulator strings to improve the efficiency.  |                  |   |   |            |               |             | K4              |  |
|   | <b>CO4:</b> Familiar in the mechanical design aspects   |                  |   |   |            |               |             | K4              |  |
| <b>CO5:</b> Familiar with the function of different components used in Transmission and Distribution levels of power system |   |                  |   |   |            |               | K3          |                 |  |
| <b>Pre-requisites</b>   | U19EE202 - Electric Circuit Analysis  |                  |   |   |            |               |             |                 |  |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |      |       |      | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|------|-------|------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |      |       |      | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO 11 | PO12 | PSO1                  | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 2                        |      |      |      |      |      |      |      |      |      |       |      | 2                     |       |       | 2     |
| CO 2   | 3                        | 3    | 1    | 2    | 2    |      |      |      |      | 2    |       |      | 3                     | 2     | 1     | 2     |
| CO 3   | 3                        | 3    | 1    | 2    | 2    |      |      |      |      |      |       |      | 3                     | 2     |       | 3     |
| CO 4   | 3                        | 3    | 1    |      |      |      |      |      |      |      |       |      | 3                     |       |       | 2     |
| CO 5   | 3                        | 3    | 2    | 2    |      | 1    |      |      |      |      |       |      | 2                     | 3     |       | 3     |

|   |  |
|---|--|
| <b>Course Assessment Methods</b>  |  |
| <b>Direct</b>   |  |
| 1. Continuous Assessment Test I, II &III<br>2. Assignment<br>3. End-Semester examinations |  |
| <b>Indirect</b>   |  |
| 1. Course - end survey  |  |

| <b>Content of the syllabus</b>   |   |         |           |
|--|---|---------|-----------|
| <b>Unit – I</b>  | <b>TRANSMISSION LINE PARAMETERS</b>   | Periods | <b>9</b>  |
| Transmission line conductors – Solid, Stranded and bundled conductors – Parameters of single and three phase transmission lines – Resistance of a transmission line – Flux linkage – Inductance calculation, single phase two – wire, three phase – symmetrical and unsymmetrical space ( single and double circuit) – Transposition of Transmission line conductors – Concept of self-GMD and mutual-GMD (single and group of conductor), Applications – Electrical potential – Capacitance calculation, Single phase two-wire, three phase symmetrical and unsymmetrical spacing – Skin and proximity effects –Interference with neighboring communication circuits. |   |         |           |
| <b>Unit - II</b>   | <b>MODELLING AND PERFORMANCE OF TRANSMISSION LINES</b>  | Periods | <b>9</b>  |
| Performance of Transmission lines- short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power - circle diagrams, surge impedance loading, methods of voltage control; Ferranti effect. Formation of Corona – Critical Voltages – Effect on Line Performance  |   |         |           |
| <b>Unit – III</b>  | <b>INSULATORS AND CABLES</b>  | Periods | <b>9</b>  |
| Main components of overhead lines – conductor materials – line supports. Insulators: Properties and Types of insulators – Voltage distribution in insulator string – Calculation of String efficiency – Improvement of String efficiency. Underground cables – Classification of Cable – Constructional features of LT and HT cables – Calculation of capacitance and dielectric stress of a single core cable – Grading of cables – Thermal resistance of the cable.  |   |         |           |
| <b>Unit - IV</b>   | <b>MECHANICAL DESIGN OF LINES AND GROUNDING</b>   | Periods | <b>9</b>  |
| Mechanical design of transmission line–Line Supports –Types of towers - Tower spotting, Types of towers, sag and tension calculations for different weather conditions, Methods of grounding.  |   |         |           |
| <b>Unit – V</b>  | <b>DISTRIBUTION OF POWER SYSTEM AND SUSTATION</b>   | Periods | <b>9</b>  |
| Types of AC and DC distributors – distributed and concentrated loads – interconnection – Trends in Transmission and Distribution: EHVAC, HVDC, Types of HVDC system- Substation Layout (AIS, GIS),   |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
| 1.   | D.P.Kothari,I.J.Nagarath,,„PowerSystemEngineering”,McGraw-HillPublishing Company limited, New Delhi, Second Edition, 2008.  |         |           |
| 2.   | C.L.Wadhwa, „Electrical Power Systems”, New Academic Science Ltd, 2009.   |         |           |
| 3.   | S.N. Singh, „Electric Power Generation, Transmission and Distribution”, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.   |         |           |
| <b>References</b>  |   |         |           |
| 1.   | B.R.Gupta, „Power System Analysis and Design” S. Chand, New Delhi, Fifth Edition, 2008.   |         |           |
| 2.   | LucesM.Fualken berry, Walter Coffey, „Electrical Power Distribution and Transmission”, Pearson Education, 2007  |         |           |
| 3.   | ArunIngoale, "power transmission and distribution" Pearson Education, 2017  |         |           |
| 4.   | J.Brian,HardyandColinR.Bayliss,,TransmissionandDistributioninElectricalEngineering”, Newnes; Fourth Edition, 2012.  |         |           |
| 5.   | V.K.Mehta,RohitMehta,,„Principlesofpowersystem”,S.Chand&CompanyLtd,NewDelhi,2013.   |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1.   | <a href="https://www.electricaleasy.com/">https://www.electricaleasy.com/</a>   |         |           |
| 2.   | <a href="https://www.sciencedirect.com/topics/engineering/electric-power-distribution">https://www.sciencedirect.com/topics/engineering/electric-power-distribution</a>                       |         |           |
| 3.   | <a href="https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108102047/lec10.pdf">https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108102047/lec10.pdf</a> |         |           |



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|--|---|------------------|-------------|-------------|-------------|---------------|-----------------|-------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b>  | Regulation  | <b>2019</b> |               |                 |             |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             | Semester    | <b>IV</b>   |               |                 |             |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name   | Periods Per Week |             |             | Credit      | Maximum Marks |                 |             |             |              |              |                       |              |              |              |              |
|  |   | L                | T           | P           | C           | CA            | ESE             | Total       |             |              |              |                       |              |              |              |              |
| <b>U19EE413</b>  | <b>Control Systems</b>  | 2                | 2           | 0           | 3           | 40            | 60              | 100         |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Understand the working mathematical model of a system.</li> <li>Analyze the time-domain and frequency-domain analyses of the model to predict the system's behavior.</li> <li>Design control systems that meet design specifications.</li> </ul> |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |             |             |             |               | Knowledge level |             |             |              |              |                       |              |              |              |              |
|  | CO1: Identify various components of the control system.   |                  |             |             |             |               | K3              |             |             |              |              |                       |              |              |              |              |
|  | CO2: Analyze various steady state errors for the continuous system.   |                  |             |             |             |               | K4              |             |             |              |              |                       |              |              |              |              |
|  | CO3: Estimate the time and frequency response of the system.  |                  |             |             |             |               | K2              |             |             |              |              |                       |              |              |              |              |
|  | CO4: Estimate the stability of the system.  |                  |             |             |             |               | K2              |             |             |              |              |                       |              |              |              |              |
| CO5: Analyze the system performance using state variable approach.   |   |                  |             |             |             | K4            |                 |             |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  | -   |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |   |                  |             |             |             |               |                 |             |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>Cos</b>   | <b>Programme Outcomes (POs)</b>   |                  |             |             |             |               |                 |             |             |              |              |                       | <b>PSOs</b>  |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b>     | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 3                | 2           | 1           | -           | -             | -               | -           | -           | -            | -            | 3                     | 3            | -            | 3            | -            |
| <b>CO 2</b>  | 3   | 2                | 2           | 2           | -           | -             | -               | -           | -           | -            | -            | 3                     | 3            | 2            | 2            | -            |
| <b>CO 3</b>  | 3   | 2                | 2           | 2           | -           | -             | -               | -           | -           | -            | -            | 3                     | 3            | 2            | 2            | -            |
| <b>CO 4</b>  | 3   | 3                | 2           | 2           | -           | -             | -               | -           | -           | -            | -            | 3                     | 3            | 1            | 1            | 1            |
| <b>CO 5</b>  | 3   | 3                | 2           | 1           | -           | -             | -               | -           | -           | -            | -            | 3                     | 2            | -            | -            | -            |
| <b>Course Assessment Methods</b>   |   |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |   |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |
| <ol style="list-style-type: none"> <li>Continuous Assessment Test I, II &amp; III</li> <li>Assignment.</li> <li>End-Semester examinations</li> </ol> |   |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |   |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |
| <ol style="list-style-type: none"> <li>Course – end survey</li> </ol>  |   |                  |             |             |             |               |                 |             |             |              |              |                       |              |              |              |              |

Signature of the BOS Chairman, EEE

| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>SYSTEMS AND THEIR REPRESENTATION</b>   | Periods | <b>9</b>  |
| Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.                                 |   |         |           |
| <b>Unit - II</b>  | <b>TIME RESPONSE</b>  | Periods | <b>9</b>  |
| Time response – Time domain specifications – Types of test input – I and II order system response –Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis. |   |         |           |
| <b>Unit – III</b>   | <b>FREQUENCY RESPONSE</b>   | Periods | <b>9</b>  |
| Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.         |   |         |           |
| <b>Unit - IV</b>  | <b>STABILITY AND COMPENSATOR DESIGN</b>   | Periods | <b>9</b>  |
| Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.  |   |         |           |
| <b>Unit – V</b>   | <b>STATE VARIABLE ANALYSIS</b>  | Periods | <b>9</b>  |
| Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability –Effect of state feedback.   |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | Sivanandam S.N, Deepa , S.N. “Control Systems Engineering” using MATLAB 2nd Ed. Vikas Publishing House Pvt. Ltd., New Delhi, NOV2009.   |         |           |
| 2.  | Nagrath I.J. and Gopal M “Control Systems Engineering” Wiley Eastern Limited, New Delhi, 5th Ed. 2008   |         |           |
| <b>References</b>   |   |         |           |
| 1.  | M. Gopal, „Control Systems, Principles and Design“, 4th Edition, Tata McGraw Hill, New Delhi,2012   |         |           |
| 2.  | S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.   |         |           |
| 3.  | Dhanesh. N. Manik, Control System, Cengage Learning, 2012.  |         |           |
| 4.  | Nagrath & Gopal, “Modern Control Engineering”, New Ages International   |         |           |
| 5.  | Arthur, G.O.Mutambara, Design and Analysis of Control; Systems, CRC Press, 2009.  |         |           |
| 6.  | Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Prentice Hall, 2012.  |         |           |
| 7.  | Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010.   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | <a href="https://www.tutorialspoint.com/control_systems/control_systems_block_diagrams.htm">https://www.tutorialspoint.com/control_systems/control_systems_block_diagrams.htm</a>                           |         |           |
| 2.  | <a href="https://www.tutorialspoint.com/control_systems/control_systems_time_response_analysis.htm">https://www.tutorialspoint.com/control_systems/control_systems_time_response_analysis.htm</a>           |         |           |
| 3.  | <a href="https://www.tutorialspoint.com/control_systems/control_systems_frequency_response_analysis.htm">https://www.tutorialspoint.com/control_systems/control_systems_frequency_response_analysis.htm</a> |         |           |
| 4.  | <a href="https://www.tutorialspoint.com/control_systems/control_systems_stability_analysis.htm">https://www.tutorialspoint.com/control_systems/control_systems_stability_analysis.htm</a>                   |         |           |
| 5.  | <a href="https://www.tutorialspoint.com/control_systems/control_systems_state_space_analysis.htm">https://www.tutorialspoint.com/control_systems/control_systems_state_space_analysis.htm</a>               |         |           |



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(Autonomous Institution, Affiliated to Anna University ,Chennai)  
Elayampalayam, Tiruchengode – 637 205



|  |  |                  |            |            |             |               |       |                 |
|--|--|------------------|------------|------------|-------------|---------------|-------|-----------------|
| Programme  | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |       |                 |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   | <b>IV</b>   |               |       |                 |
| Course Code  | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |       |                 |
|  |  | L                | T          | P          | C           | CA            | ESE   | Total           |
| <b>U19CS417</b>  | <b>Data Structures</b>   | 3                | 0          | 0          | 3           | 40            | 60    | 100             |
| <b>Course Objective</b>  | The student should be made to,   |                  |            |            |             |               |       |                 |
|  | <ul style="list-style-type: none"> <li>• Impart the basic concept of list ADT.</li> <li>• Learn the linear data structures such as stack and queue.</li> <li>• Describe the non linear data structures such as Tree and Graphs.</li> <li>• Examine various algorithms for finding shortest path and minimum spanning tree.</li> <li>• Analyze various searching, sorting algorithms and hashing techniques.</li> </ul> |                  |            |            |             |               |       |                 |
|  | At the end of the course, the student should be able to,   |                  |            |            |             |               |       | Knowledge level |
|  | <b>CO1:</b> Implement abstract data type for list and operations.  |                  |            |            |             |               |       | K3              |
|  | <b>CO2:</b> Apply the stack and queue data structure for problem solution.   |                  |            |            |             |               |       | K3, K4          |
| <b>CO3:</b> Analyze various tree data structures to implement various applications                   |  |                  |            |            |             |               | K4    |                 |
| <b>CO4:</b> Critically analyze and solve the problems in finding shortest path and minimum spanning. |  |                  |            |            |             |               | K5    |                 |
| <b>CO5:</b> Demonstrate the various searching, sorting algorithms and hashing techniques             |  |                  |            |            |             |               | K3,K4 |                 |
| <b>Pre-requisites</b>  | -  |                  |            |            |             |               |       |                 |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 |
| <b>CO 1</b>  | 3                        | 3    | 3    | 2    |      |      |      |      |      |       |       | 2     | 2                     | 2     |       |
| <b>CO 2</b>  | 3                        | 3    | 3    | 2    |      |      |      |      |      |       |       | 2     | 2                     | 2     |       |
| <b>CO 3</b>  | 3                        | 3    | 3    | 3    |      |      |      |      |      |       |       | 2     | 2                     | 3     |       |
| <b>CO 4</b>  | 3                        | 3    | 3    | 2    |      |      |      |      |      |       |       | 2     | 2                     | 3     |       |
| <b>CO 5</b>  | 3                        | 3    | 3    | 3    |      |      |      |      |      |       |       | 2     | 2                     | 3     |       |

**Course Assessment Methods**

|   |
|---|
| <b>Direct</b>                             |
| 1. Continuous Assessment Test I, II & III |
| 2. Assignment                             |
| 3. End-Semester examinations              |
| <b>Indirect</b>                           |
| 1. Course – end survey                    |

Signature of the BOS Chairman, EEE

| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>LINEAR DATA STRUCTURE – LIST</b>   | Periods | <b>9</b>  |
| Abstract Data Types (ADTs) – List ADT – Array Implementation – Linked List Implementation — Singly Linked Lists – Circular Linked Lists – Doubly Linked Lists – Applications of Lists – Polynomial operations (Insertion, Deletion, Merge, Traversal).        |   |         |           |
| <b>Unit - II</b>  | <b>LINEAR DATA STRUCTURE – STACKS, QUEUES</b>   | Periods | <b>9</b>  |
| Stack ADT – Operations – Application: Evaluating Arithmetic Expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – DeQueue – Applications of queues.  |   |         |           |
| <b>Unit – III</b>   | <b>NON LINEAR DATA STRUCTURE – TREES</b>  | Periods | <b>9</b>  |
| Terminologies – Tree ADT – Binary Tree – Tree Traversals – Expression Trees – Applications of Trees – Binary Search Tree ADT - AVL Trees – B- Trees – Heap – Applications of Heap.  |   |         |           |
| <b>Unit - IV</b>  | <b>NON LINEAR DATA STRUCTURES – GRAPHS</b>  | Periods | <b>9</b>  |
| Definition – Representation of Graph – Types of graph – Breadth-First Traversal – Depth-First Traversal – Topological Sort – Shortest Path Algorithms - Minimum Spanning Tree - Applications of graphs.   |   |         |           |
| <b>Unit – V</b>   | <b>SEARCHING, SORTING &amp; HASHING TECHNIQUES</b>  | Periods | <b>9</b>  |
| Searching: Linear Search – Binary Search, Sorting: Bubble sort – Selection sort – Insertion sort – Shell sort – Quick Sort, Hashing: Hash Functions – Collision Resolution Techniques – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing. |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | Mark Allen Weiss — Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2011                                     |         |           |
| 2.  | Reema Thareja — Data Structures Using C, Second Edition , Oxford University Press, 2011   |         |           |
| <b>References</b>   |   |         |           |
| 1.  | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein — “Introduction to Algorithms”, Second Edition, Mcgraw Hill, 2002. |         |           |
| 2.  | Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, — “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008        |         |           |
| 3.  | Stephen G. Kochan, — “Programming in C”, Third edition, Pearson Education.  |         |           |
| 4.  | Joe Bentley — “Programming Pearls”, Second Edition, Pearson Education, 2006   |         |           |
| 5.  | Steven S. Skiena — “The Algorithm Design Manual”, Second Edition, Springer, 2010.   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | <a href="https://www.edx.org/course/algorithms-and-data-structures">https://www.edx.org/course/algorithms-and-data-structures</a>           |         |           |
| 2.  | <a href="https://hackr.io/tutorials/learn-data-structures-algorithms">https://hackr.io/tutorials/learn-data-structures-algorithms</a>       |         |           |
| 3.  | <a href="https://www.learneroo.com/subjects/8">https://www.learneroo.com/subjects/8</a>   |         |           |



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|  |   |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
|--|---|------------------|------|------|------------|---------------|-------------|-----------------|-------|-------|-------|-------|-----------------------|-------|-------|-------|
| Programme  | <b>B.E.</b>   | Programme Code   |      |      | <b>102</b> | Regulation    | <b>2019</b> |                 |       |       |       |       |                       |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |      |      | Semester   |               | <b>IV</b>   |                 |       |       |       |       |                       |       |       |       |
| Course Code  | Course Name   | Periods Per Week |      |      | Credit     | Maximum Marks |             |                 |       |       |       |       |                       |       |       |       |
|  |   | L                | T    | P    |            | C             | CA          | ESE             | Total |       |       |       |                       |       |       |       |
| <b>U19EE414</b>  | <b>AC Machines Laboratory</b>   | 0                | 0    | 4    | 2          | 60            | 40          | 100             |       |       |       |       |                       |       |       |       |
| <b>Course Objective</b>  | The students should made to<br>• Evaluate the performance of various Ac machines by conducting appropriate Experiments. |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |      |      |            |               |             | Knowledge Level |       |       |       |       |                       |       |       |       |
|  | <b>CO1:</b> Calculate the regulation of a three-phase alternator by different methods                                   |                  |      |      |            |               |             | K2              |       |       |       |       |                       |       |       |       |
|  | <b>CO2:</b> Measure negative sequence and zero sequence impedance of alternators.                                       |                  |      |      |            |               |             | K2              |       |       |       |       |                       |       |       |       |
|  | <b>CO3:</b> Synchronization of synchronous machine to mains and determine V and inverted V curves                       |                  |      |      |            |               |             | K2              |       |       |       |       |                       |       |       |       |
|  | <b>CO4:</b> Predetermine the performance of induction motor by conducting no-load and blocked rotor tests.              |                  |      |      |            |               |             | K2              |       |       |       |       |                       |       |       |       |
| <b>CO5:</b> Predetermine the performance of Load test on single-phase & three-phase induction motor. |   |                  |      |      |            |               | K2          |                 |       |       |       |       |                       |       |       |       |
| <b>Pre-requisites</b>  | -   |                  |      |      |            |               |             |                 |       |       |       |       |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |   |                  |      |      |            |               |             |                 |       |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
| <b>COs</b>   | Programme Outcomes (POs)  |                  |      |      |            |               |             |                 |       |       |       |       | PSOs                  |       |       |       |
|  | PO 1  | PO 2             | PO 3 | PO 4 | PO 5       | PO 6          | PO 7        | PO 8            | PO 9  | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| <b>CO 1</b>  | 3   | 2                | 3    | -    | 1          | 2             | -           | -               | 2     | 1     | 2     | 2     | 2                     | 1     | 1     | -     |
| <b>CO 2</b>  | 3   | 2                | 3    | 1    | 1          | -             | -           | -               | 1     | -     | 2     | 1     | 1                     | 1     | 2     | -     |
| <b>CO 3</b>  | 3   | 2                | 3    | -    | 1          | 2             | 1           | -               | 2     | -     | 1     | 2     | 1                     | 1     | 2     | -     |
| <b>CO 4</b>  | 3   | 3                | 3    | 1    | 1          | -             | -           | -               | 2     | -     | 1     | 1     | 2                     | 1     | 1     | -     |
| <b>CO 5</b>  | 3   | 3                | 3    | 2    | 2          | 1             | -           | -               | 1     | 2     | 1     | 2     | 1                     | 1     | 1     | -     |



**Course Assessment Methods****Direct**



1. Pre lab and Post lab test
2. Record mark
3. End-Semester examinations

**Indirect**

1. Course – end survey

**Content of the syllabus**


| S.No                | LIST OF EXPERIMENTS   | Course Outcome | Program Outcome & Program Specific Outcome |
|---------------------|---|----------------|--|
| 1.                  | Regulation of three phase alternator by EMF and MMF methods.                  | CO1            | PO1,PO4,PO9,PSO1,PSO3                      |
| 2.                  | Regulation of three phase alternator by ZPF method.                           | CO1            | PO1,PO4,PO9,PSO1,PSO3                      |
| 3.                  | Regulation of three phase salient pole alternator by slip test.               | CO1            | PO1,PO4,PO9,PSO1,PSO3                      |
| 4.                  | Measurements of negative sequence and zero sequence impedance of alternators. | CO2            | PO1, PO9,PSO1                              |
| 5.                  | V and Inverted V curves of Three Phase Synchronous Motor.                     | CO3            | PO1, PO9,PSO1                              |
| 6.                  | Load test on three-phase induction motor.                                     | CO5            | PO1, PO9,PSO1                              |
| 7.                  | No load and blocked rotor test on three-phase induction motor.                | CO4            | PO1, PO9,PSO1                              |
| 8.                  | Separation of No-load losses of three-phase induction motor.                  | CO4            | PO1,PO4,PO9,PSO1,PSO3                      |
| 9.                  | Load test on single-phase induction motor.                                    | CO5            | PO1, PO9,PSO1                              |
| 10.                 | No load and blocked rotor test on single-phase induction motor.               | CO4            | PO1, PO9,PSO1                              |
| <b>Total Period</b> |   |                | <b>60</b>                                  |

|   |   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
|---|---|------------------|-----|--------|-----|---------------|--|-----------------|-----------|------|------|----------------------|--------------|------|------|------|
|                           | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| Programme   | <b>B.E.</b>   | Programme Code   |     |        |     | <b>102</b>    | Regulation <b>2019</b>   |                 |           |      |      |                      |              |      |      |      |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |     |        |     |               | Semester   |                 | <b>IV</b> |      |      |                      |              |      |      |      |
| Course Code   | Course Name   | Periods Per Week |     | Credit |     | Maximum Marks |  |                 |           |      |      |                      |              |      |      |      |
|   |   | L                | T   | P      | C   | CA            | ESE  | Total           |           |      |      |                      |              |      |      |      |
| <b>U19EE415</b>   | <b>Linear Integrated Circuits Laboratory</b>  | 0                | 0   | 4      | 2   | 50            | 50   | 100             |           |      |      |                      |              |      |      |      |
| <b>Course Objective</b>   | The students should made to<br>• Enrich the knowledge on practical circuit design using analog and digital ICs.   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |     |        |     |               |  | Knowledge level |           |      |      |                      |              |      |      |      |
|   | <b>CO1:</b> Understand the industrial Applications of OPAMP in closed and open loop   |                  |     |        |     |               |  | K2              |           |      |      |                      |              |      |      |      |
|   | <b>CO2:</b> Design the analog filters and multi vibrators based on specific applications  |                  |     |        |     |               |  | K3              |           |      |      |                      |              |      |      |      |
|   | <b>CO3:</b> Get the output verification of A/D and D/A converters   |                  |     |        |     |               |  | K3              |           |      |      |                      |              |      |      |      |
|   | <b>CO4:</b> Design sequential and combinational circuits.   |                  |     |        |     |               |  | K4              |           |      |      |                      |              |      |      |      |
| <b>CO5:</b> Show the functions of NE/SE 555 timer (Astable and Monostable), 565(VCO and PLC) and 566(V/I) |   |                  |     |        |     |               | K2   |                 |           |      |      |                      |              |      |      |      |
| <b>Pre-requisites</b>   | -   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| <b>CO/PO Mapping</b><br>(3/2/1 indicates strength of correlation)3-Storng,2-Medium,1-Week                 |   |                  |     |        |     |               |  |                 |           |      |      | <b>CO/PO Mapping</b> |              |      |      |      |
| <b>COs</b>  | Programme outcomes(POs)   |                  |     |        |     |               |  |                 |           |      |      |                      | <b>PSO s</b> |      |      |      |
|   | PO1   | PO2              | PO3 | PO4    | PO5 | PO6           | PO7  | PO8             | PO9       | PO10 | PO11 | PO12                 | PSO1         | POS2 | POS3 | POS4 |
| <b>CO1</b>  | 3   | 2                | 2   |        | 1   | 1             |  |                 | 1         |      | 1    | 1                    | 3            | 2    |      |      |
| <b>CO2</b>  | 3   | 2                | 2   |        | 1   | 1             |  |                 | 1         |      | 1    | 1                    | 3            | 2    |      |      |
| <b>CO3</b>  | 3   | 2                | 2   |        | 1   | 1             |  |                 | 1         |      | 1    | 1                    | 3            | 2    |      |      |
| <b>CO4</b>  | 3   | 2                | 2   |        | 1   | 1             |  |                 | 1         |      | 1    | 1                    | 3            | 2    |      |      |
| <b>CO5</b>  | 3   | 2                | 2   |        | 1   | 1             |  |                 | 1         |      | 1    | 1                    | 3            | 2    |      |      |
| <b>Course Assessment Methods</b>  |   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| <b>Direct</b>   |   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| 1. Pre lab and post lab test<br>2. Record mark<br>3. End-Semester examinations                            |   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| <b>Indirect</b>   |   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |
| 1. Course - end survey  |   |                  |     |        |     |               |  |                 |           |      |      |                      |              |      |      |      |

**Content of the syllabus**

| <b>S.No</b>          | <b>LIST OF EXPERIMENTS</b>  | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
|----------------------|---|-----------------------|---|
| 1.                   | Inverting, Non – Inverting amplifiers using op -amp               | CO1                   | PO3,PSO1  |
| 2.                   | Integrator and differentiator using op - amp                      | CO1                   | PO3, PSO1,PSO3  |
| 3.                   | Instrumentation amplifier using op -amp                           | CO1                   | PO1,PO3,PSO1  |
| 4.                   | Differential amplifier using op -amp                              | CO1                   | PO1, PSO1,PSO3  |
| 5.                   | Active low pass, high pass and band pass filters                  | CO4                   | PO2,<br>PSO1,PSO3,PSO4                                |
| 6.                   | Comparator clipper and clamper using op -amp                      | CO3                   | PO3,PSO1,PSO3   |
| 7.                   | Wein bridge oscillators using op -amp                             | CO3                   | PO3,PSO1,PSO3   |
| 8.                   | A/D and D/A converter.  | CO3                   | PO2,PSO3,PSO4   |
| 9.                   | A stable, Monostable and Bistable multi vibrators using op – amp  | CO2                   | PO2,PSO3, PSO1  |
| 10.                  | Study of PLL characteristics and its use as frequency multiplier. | CO5                   | PO1,PSO1  |
| <b>Total Periods</b> |   |                       | <b>60</b>   |

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|  |  |                                |            |            |            |               |   |             |            |            |             |             |                       |             |             |             |             |
|--|--|--------------------------------|------------|------------|------------|---------------|---|-------------|------------|------------|-------------|-------------|-----------------------|-------------|-------------|-------------|-------------|
|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                                |            |            |            |               |  |             |            |            |             |             |                       |             |             |             |             |
| Programme  | <b>B.E.</b>  | Programme Code                 |            |            |            | Regulation    |   | <b>2019</b> |            |            |             |             |                       |             |             |             |             |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                                |            |            | Semester   |               | <b>IV</b>   |             |            |            |             |             |                       |             |             |             |             |
| Course Code  | Course Name  | Periods PerWeek                |            |            | Credit     | Maximum Marks |   |             |            |            |             |             |                       |             |             |             |             |
|  |  | L                              | T          | P          | C          | ESE           | Total   |             |            |            |             |             |                       |             |             |             |             |
| <b>U19MCSY4</b>  | <b>VERBALABILITY</b>   | 3                              | 0          | 0          | -          | -             | 100   |             |            |            |             |             |                       |             |             |             |             |
| <b>Course Objective</b>  | <b>The main objective of the course is to:</b> <ul style="list-style-type: none"> <li>To help the student understand the importance of having his language skills kept ready for effective use</li> <li>To provide a host of varied opportunities for the student to hone his acquired language skills basic components, namely, Grammar, Vocabulary, Spelling and Comprehension.</li> </ul> |                                |            |            |            |               |   |             |            |            |             |             |                       |             |             |             |             |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                                |            |            |            |               | KL  |             |            |            |             |             |                       |             |             |             |             |
|  | <b>CO1:</b> , Identify the verb and tense in a sentence by circling and labeling   |                                |            |            |            |               | K1  |             |            |            |             |             |                       |             |             |             |             |
|  | <b>CO2:</b> State the definition of an article   |                                |            |            |            |               | K1  |             |            |            |             |             |                       |             |             |             |             |
|  | <b>CO3:</b> Develop their awareness of correct usage of English grammar in writing and speaking .  |                                |            |            |            |               | K3  |             |            |            |             |             |                       |             |             |             |             |
|  | <b>CO4:</b> Tests a vocabulary power and skill to follow the logic of sentences  |                                |            |            |            |               | K4  |             |            |            |             |             |                       |             |             |             |             |
|  | <b>CO5:</b> Discuss how word root based extends vocabulary   |                                |            |            |            |               | K2  |             |            |            |             |             |                       |             |             |             |             |
| <b>Pre-requisites</b>  |  |                                |            |            |            |               |   |             |            |            |             |             |                       |             |             |             |             |
|  | <b>CO/PO Mapping</b><br>(3/2/1indicatesstrength of correlation)3-Strong,2- Medium,1-Weak   |                                |            |            |            |               |   |             |            |            |             |             | <b>CO/PSO Mapping</b> |             |             |             |             |
|  | <b>COs</b>   | <b>Programme Outcomes(POs)</b> |            |            |            |               |   |             |            |            |             |             |                       | <b>PSOs</b> |             |             |             |
|  |  | <b>PO1</b>                     | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b>    | <b>PO6</b>  | <b>PO7</b>  | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b>           | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> |
|  | <b>CO 1</b>  |                                |            |            |            | 2             |   |             | 3          | 3          |             | 3           |                       | 2           |             |             |             |
|  | <b>CO 2</b>  |                                |            |            |            | 2             |   |             | 3          | 3          |             | 3           |                       | 2           |             |             |             |
|  | <b>CO 3</b>  |                                |            |            |            | 2             |   |             | 3          | 3          |             | 3           |                       | 2           |             |             |             |
| <b>CO 4</b>  |  |                                |            |            | 2          |               |   | 3           | 3          |            | 3           |             | 2                     |             |             |             |             |
| <b>CO 5</b>  |  |                                |            |            | 2          |               |   | 3           | 3          |            | 3           |             | 2                     |             |             |             |             |
| <b>Content of the syllabus</b>   |  |                                |            |            |            |               |   |             |            |            |             |             |                       |             |             |             |             |
| <b>Unit– I</b>   | <b>TENSES</b>  |                                |            |            |            |               |   |             |            |            |             |             | Periods               | <b>6</b>    |             |             |             |
| Purposeandrulesoftensesanditskeywords(focusshouldbegiventopresentcontinuous,futurecontinuous,presentperfect,futureperfect,presentperfectcontinuous,pastperfectcontinuous,futureperfectcontinuous<br>With more examples) -Direct and Indirect Speech –Voices.   |  |                                |            |            |            |               |   |             |            |            |             |             |                       |             |             |             |             |
| <b>Unit-II</b>   | <b>ARTICLES</b>  |                                |            |            |            |               |   |             |            |            |             |             | Periods               | <b>6</b>    |             |             |             |
| <b>Purpose of Articles: Indefinite Article:</b> If you want to say about ANY item, you should use the articles A /An.A:AEuropean,AOneEyedbeggar,AUniversity,AUsefulWebsite.Nameofprofessions,Expressionof quantity, To make a Proper noun a Common noun, With certain numbers, used before the word 'Half' when it follows a whole number. <b>Exceptions: Choosing A or An</b> There are a few exceptions to the general rule of using a before words that start with consonants and an before words that begin with vowels. The first letter of the word honor, for example, is |  |                                |            |            |            |               |   |             |            |            |             |             |                       |             |             |             |             |

a consonant, but it's unpronounced. In spite of its spelling, the word honor begins with a vowel sound. Therefore, we use an. **Example.**

**The Definite Article:**

Where to use the Definite Article -A specific item, a particular person or thing, Before superlative forms, Before double comparatives, Before musical instruments, Before rank or title, Before name of the political parties, armed forces, physical positions, Before a Proper noun when used as a Common noun, Before some adjectives to make them nouns, Before Ordinal numbers, Before the names of Oceans, Seas, Rivers, Canals, Deserts, Groups of Mountains and Groups of Islands, Before the names of the Things, which are unique in nature, Before the names of Planets and Satellites, Before Holy Books, Before the names of News Papers, Before the names of some countries ,measuring expressions beginning with by.**Omission of articles:**

**Before Plural countable noun, Before proper noun, Before languages, a single item of uncountable noun, Before name of the meals except adjective usage, Double expressions – with wife and fork, with hat and folk, from top to bottom, With the names of meals such as Breakfast, Before predicative nouns denoting a unique position, After type of / kind of / sort of / post of / title of / rank of / articles are not used. Ex. He is not that sort of man, Articles are not used with material nouns, After di-transitive verb articles should not be used except when it is used as mono transitive verb, Before the names of meals no article should be used in a general way except in particular causes.**

**Repetition of the articles**

1. When two or more adjectives qualify the same noun, the article is used before the first adjective only; but when they qualify different nouns, expressed or understood, the article is used before each adjective.

**PREPOSITIONS**

- a. PrepositionsOfTime-On,In,At,Since,For,Ago,During,Before,After,Until,Till,To/Past,From/To,By
- b. PrepositionsOfPlace-In,At,On,Off,By,Beside,Under,Over,Below,Above,UpAndDown,Ago
- c. PrepositionsOfDirections/MovementsAcross,Through,To,Into,OutOf,Onto,Towards,From
- d. Other Prepositions-Of,By, About ,For, With Prepositions UsagewithItsContext

|                   |                            |         |          |
|-------------------|----------------------------|---------|----------|
| <b>Unit – III</b> | <b>SENTENCE CORRECTION</b> | Periods | <b>6</b> |
|-------------------|----------------------------|---------|----------|

**SENTENCE CORRECTION**

- a) In each of the following sentences, four options are given. You are required to identify the best way of writing the sentence in the context of the correct usage of standard written English. While doing so, you have to ensure the message being conveyed remains the same in all the cases.
- b) For each of the following questions, a part or the whole of the original sentence has been underlined. You have to find the best way of writing he underlined part of the sentence.
- c) In the following questions, you have to identify the correct sentence/s. For each of the following questions, find the sentence/s that are correct.
- d) In each of the following questions, one or more of the sentences is/are incorrect. You have to identify the incorrect sentence/s.

**SENTENCE IMPROVEMENT**

- a. Subject-Verb Agreement
- b. Parallelism
- c. Redundancy: The error of repeating the same thing.
- d. Modifier
- e. Comparisons

**RULE:**(a) When comparative degree is used with than ,make sure that we excluded the thing compared from the rest of class of things by using the

- f. Confusing words
  - i) Few and Less
  - ii) Few and A few
  - iii) Little and A Little

g. A little tact would have saved the situation (some tact). Lay and Lie Lay, laid

|                  |                            |         |          |
|------------------|----------------------------|---------|----------|
| <b>Unit – IV</b> | <b>SENTENCE CORRECTION</b> | Periods | <b>6</b> |
|------------------|----------------------------|---------|----------|

**SENTENCE CORRECTION**

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- e) In each of the following sentences, four options are given. You are required to identify the best way of writing the sentence in the context of the correct usage of standard written English. While doing so, you have to ensure the message being conveyed remains the same in all the cases.
- f) For each of the following questions, a part or the whole of the original sentence has been underlined. You have to find the best way of writing the underlined part of the sentence.
- g) In the following questions, you have to identify the correct sentence/s. For each of the following questions, find the sentence/s that are correct.
- h) In each of the following questions, one or more of the sentences is/are incorrect. You have to identify the incorrect sentence/s.

**SENTENCE IMPROVEMENT**

- a. Subject-Verb Agreement
- b. Parallelism
- c. Redundancy: The error of repeating the same thing.
- d. Modifier
- e. Comparisons

RULE: (a) When comparative degree is used with than, make sure that we exclude the thing compared from the rest of class of things by using the

- f. Confusing words
  - i) Few and Less
  - ii) Few and A few
  - iii) Little and A little

g. A little tact would have saved the situation (some tact). Lay and Lie Lay, laid

|                |                            |         |          |
|----------------|----------------------------|---------|----------|
| <b>Unit-IV</b> | <b>SENTENCE COMPLETION</b> | Periods | <b>6</b> |
|----------------|----------------------------|---------|----------|

**SENTENCE COMPLETION : Purpose and usage of proper words. SPOTTING ERRORS:**

- a. Error on conjunctions
- b. Error on „if“ clauses
- c. Errors on adverbs
- d. Error on adjectives
- e. Error on prepositions
- f. Error on determiners
- g. Error on verbs
- h. Errors on nouns
- i. Error on modifiers
- j. Errors on degrees of comparison
- k. Errors on subject-verb agreement
- l. Error on infinitives
- m. Errors on pronouns
- n. Errors on tenses
- o. Redundancy errors
- p. Error on articles

Error on complex sentences

|                |                   |         |          |
|----------------|-------------------|---------|----------|
| <b>Unit- V</b> | <b>VOCABULARY</b> | Periods | <b>6</b> |
|----------------|-------------------|---------|----------|

Synonyms: Root Based Word, Suffix Based Word. Antonyms-Contextual Vocabulary-Verbal Analogy

**Total Periods 30**

**Text Books**

- 1. Objective General English by SP Bakshi – Arihant Publication

**References**

- 1. A modern approach to verbal and non-verbal reasoning by R.S. Agarwal
- 2. Word power made easy by Norman Lewis



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(Autonomous Institution, Affiliated to Anna University ,Chennai)  
Elayampalayam, Tiruchengode – 637 205



|   |   |                  |            |            |             |               |    |                        |
|---|---|------------------|------------|------------|-------------|---------------|----|------------------------|
| Programme   | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |    |                        |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>V</b>    |               |    |                        |
| Course Code   | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |    |                        |
|   |   | L                | T          | P          |             | C             | CA | ESE                    |
| <b>U19EE516</b>   | <b>Microprocessors and Microcontrollers</b>   | 3                | 0          | 0          | 3           | 40            | 60 | 100                    |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Understand the Architecture of <math>\mu</math>P8085 &amp; <math>\mu</math>C8051.</li> <li>• Learn the design aspects of I/O and Memory Interfacing.</li> <li>• Learn the design aspects Addressing modes, Instruction set Interrupt structure of 8085 &amp; 8051.</li> <li>• Design and develop <math>\mu</math>P8085 &amp; <math>\mu</math>C 8051 based system.</li> </ul> |                  |            |            |             |               |    |                        |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |            |            |             |               |    | <b>Knowledge Level</b> |
|   | <b>CO1:</b> Explain the architecture of Microprocessor, addressing modes & Instruction set of 8085.   |                  |            |            |             |               |    | K2                     |
|   | <b>CO2:</b> Use of Interrupt structure 8085 and programming   |                  |            |            |             |               |    | K2                     |
|   | <b>CO3:</b> Understand the architecture of Microcontroller, and programming with 8051.  |                  |            |            |             |               |    | K2                     |
|   | <b>CO4:</b> Understand the importance of Interfacing and its programming  |                  |            |            |             |               |    | K2                     |
| <b>CO5:</b> Develop the Microprocessor and Microcontroller based applications |   |                  |            |            |             |               | K3 |                        |
| <b>Pre-requisites</b>   |   |                  |            |            |             |               |    |                        |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3                        | 2    | 2    | 3    | 2    | 3    | 3    | -    | -    | 3     | 3     | -     | 3                     | -     | 2     | 2     |
| CO 2   | 3                        | 2    | 2    | 3    | 2    | 3    | 3    | -    | -    | 3     | 3     | -     | 3                     | -     | 3     | 2     |
| CO 3   | 3                        | 2    | 2    | 3    | 3    | 3    | 3    | -    | -    | 3     | 3     | -     | 3                     | -     | 3     | 3     |
| CO 4   | 3                        | 3    | 2    | 3    | 3    | 3    | 3    | -    | -    | 3     | 3     | -     | 3                     | -     | 3     | 3     |
| CO 5   | 3                        | 3    | 2    | 3    | 3    | 3    | 3    | -    | -    | 3     | 3     | -     | 3                     | -     | 3     | 3     |

### Course Assessment Methods

#### Direct

1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations



#### Indirect

1. Course – end Survey



Signature of the BOS Chairman, EEE

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION TO 8-BIT MICROPROCESSOR</b>   | <b>Periods</b> | <b>9</b>  |
| General 8-bit microprocessor and its architecture - 8085 functional block diagram - Pin configurations – Memory organization - I/O ports - Data transfer techniques: Programmed I/O, Interrupt Driven I/O, Direct Memory Access - Timing Diagram – Interrupts-PIC and ARM processors.  |   |                |           |
| <b>Unit - II</b>   | <b>INSTRUCTIONSETS AND ASSEMBLY LANGUAGE PROGRAMMING OF 8085 PROCESSOR</b>  | <b>Periods</b> | <b>9</b>  |
| Instruction Set: Format and addressing modes – Data transfer, Arithmetic, Logical, Branch, Stack and Machine control group of instruction set; Unspecified flags and Instructions Assembly Language Programming: Assembler Directives – ALU operations - Code conversions – Program using Rotate and control Instructions - Subroutines, parameter passing – Stack operations - Programming using look up table. |   |                |           |
| <b>Unit – III</b>  | <b>8051 MICRO CONTROLLER – INSTRUCTION SET, PROGRAMMING</b>   | <b>Periods</b> | <b>9</b>  |
| Architecture, pin outs – Functional Building Blocks of Processor – Memory organization – Special Function Registers - I/O ports operation – Timing Diagram – Interrupts, Data Transfer, Manipulation, Control Algorithms & I/O instructions, Comparison to Programming concepts with8085.  |   |                |           |
| <b>Unit - IV</b>   | <b>PERIPHERAL DEVICES AND INTERFACING WITH 8085&amp; 8051</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction, memory and I/O interfacing, data transfer schemes, programmable peripheral interface (8255), programmable DMA controller (8257), programmable interrupt controller (8259), programmable communication interface (8251), programmable counter/interval timer (8253/54), A/D and D/A converters, Keyboard and display controller (8279).   |   |                |           |
| <b>Unit – V</b>  | <b>SYSTEM DESIGN USING MICRO CONTROLLER</b>   | <b>Periods</b> | <b>9</b>  |
| Case Studies: Traffic Light control – Washing Machine control – RTC interfacing using I2C standard - PWM - Application to automation systems: Control of servo motor, and stepper motor.   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | R.S. Gaonkar, „Microprocessor Architecture Programming and Application“, with 8085, Wiley Eastern Ltd., New Delhi, 2013.  |                |           |
| 2.   | Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely „The 8051 Micro Controller and Embedded Systems“, PHI Pearson Education, 5th Indian reprint, 2003.                    |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Douglas V.Hall,„MicroprocessorandInterfacing“,McGrawHillEdu,2016.   |                |           |
| 2.   | Ajay V.Deshmukh, „Microcontroller Theory &Applications“, McGraw Hill Edu,2016.  |                |           |
| 3.   | Sunil Mathur & Jeebananda Panda, “Microprocessor and Microcontrollers”, PHI Learning Pvt. Ltd, 2016.  |                |           |
| 4.   | Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.                                  |                |           |
| 5.   | Krishna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.  |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://adityaeeeb.weebly.com/uploads/4/2/0/0/42007913/mpmc_textbook_godse.pdf">https://adityaeeeb.weebly.com/uploads/4/2/0/0/42007913/mpmc_textbook_godse.pdf</a> |                |           |
| 2.   | <a href="https://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf">https://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf</a>                                       |                |           |
| 3.   | <a href="https://rk2bukz.cf/read.php?id=P-n3kelycHQC">https://rk2bukz.cf/read.php?id=P-n3kelycHQC</a>   |                |           |



|  |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
|--|--|------------------|-------------|-------------|-------------|---|-------------|------------------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |             |  |             |                        |             |              |              |                       |              |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code   |             |             | <b>102</b>  | Regulation  | <b>2019</b> |                        |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             | Semester    |   | <b>V</b>    |                        |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit      | Maximum Marks   |             |                        |             |              |              |                       |              |              |              |              |
|  |  | L                | T           | P           |             | C   | CA          | ESE                    | Total       |              |              |                       |              |              |              |              |
| <b>U19EE517</b>  | <b>Power System Protection and Switchgear</b>  | 3                | 0           | 0           | 3           | 40  | 60          | 100                    |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Learn the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.</li> <li>Understand the characteristics and functions of relays and protection schemes.</li> <li>Understand the problems associated with circuit interruption by a circuit breaker</li> </ul> |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |             |             |             |   |             | <b>Knowledge Level</b> |             |              |              |                       |              |              |              |              |
|  | <b>CO1:</b> Understand the causes of abnormal operating conditions of the system.  |                  |             |             |             |   |             | K2                     |             |              |              |                       |              |              |              |              |
|  | <b>CO2:</b> Classify and describe the working of various relaying schemes  |                  |             |             |             |   |             | K2                     |             |              |              |                       |              |              |              |              |
|  | <b>CO3:</b> Identify and implement an appropriate relaying schemes for different power apparatus.  |                  |             |             |             |   |             | K2                     |             |              |              |                       |              |              |              |              |
|  | <b>CO4:</b> Analyze the problem associated with current interruption by a circuit breaker.   |                  |             |             |             |   |             | K3                     |             |              |              |                       |              |              |              |              |
| <b>CO5:</b> Illustrate the function of various CBs and related switching issues  |  |                  |             |             |             |   | K3          |                        |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |  |                  |             |             |             |   |             |                        |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |             |             |             |   |             |                        |             |              |              |                       | PSOs         |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 2                | 2           | 3           | 2           | 3   | 3           | -                      | -           | 3            | 3            | -                     | 3            | -            | 2            | 2            |
| <b>CO 2</b>  | 3  | 2                | 2           | 3           | 2           | 3   | 3           | -                      | -           | 3            | 3            | -                     | 3            | -            | 3            | 2            |
| <b>CO 3</b>  | 3  | 2                | 2           | 3           | 3           | 3   | 3           | -                      | -           | 3            | 3            | -                     | 3            | -            | 3            | 3            |
| <b>CO 4</b>  | 3  | 3                | 2           | 3           | 3           | 3   | 3           | -                      | -           | 3            | 3            | -                     | 3            | -            | 3            | 3            |
| <b>CO 5</b>  | 3  | 3                | 2           | 3           | 3           | 3   | 3           | -                      | -           | 3            | 3            | -                     | 3            | -            | 3            | 3            |
| <b>Course Assessment Methods</b>   |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
| <ol style="list-style-type: none"> <li>Continuous Assessment Test I, II &amp;III</li> <li>Assignment</li> <li>End-Semester examinations</li> </ol> |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |
| <ol style="list-style-type: none"> <li>Course – end Survey</li> </ol>  |  |                  |             |             |             |   |             |                        |             |              |              |                       |              |              |              |              |

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>INTRODUCTION</b>   | <b>Periods</b> | <b>9</b>  |
| Importance of protective schemes for electrical apparatus and power system. - relay terminology – definitions - and essential qualities of protection. Protection against over voltages due to lightning and switching - arcing grounds - Peterson Coil - ground wires – surge absorber and diverters Power System earthing – neutral earthing. |   |                |           |
| <b>Unit - II</b>  | <b>OPERATING PRINCIPLES AND RELAY CHARACTERISTICS</b>   | <b>Periods</b> | <b>9</b>  |
| Electromagnetic relays: over current (directional and non-directional), distance, negative sequence and differential relays –Introduction to static relays- digital Protection of synchronous generator and transmission lines.   |   |                |           |
| <b>Unit – III</b>   | <b>APPARATUS PROTECTION</b>   | <b>Periods</b> | <b>9</b>  |
| Main considerations in apparatus protection- transformer and generator protection-protection of bus bars. Transmission line and feeder protection - zones of protection.  |   |                |           |
| <b>Unit - IV</b>  | <b>THEORY OF CIRCUIT INTERRUPTION</b>   | <b>Periods</b> | <b>9</b>  |
| Physics of arc phenomena and arc interruption. restriking voltage and recovery voltage -rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current- DC circuit breaking.   |   |                |           |
| <b>Unit – V</b>   | <b>CIRCUIT BREAKERS</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction of circuit breaker-Types of circuit breakers – air blast, Oil, SF6 and vacuum circuit breakers – comparative merits of different circuit breakers- testing of circuit breakers- MCB-MCCB-ELCB-RCCB.  |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | B. Ravindranath, and N. Chander, „Power System Protection & Switchgear“, New Age International (P) Limited, 2014.   |                |           |
| 2.  | Singh L.P.,—Digital Protection, Second edition New Age International (P) Limited, New Delhi, 2004.  |                |           |
| <b>References</b>   |   |                |           |
| 1.  | M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, „A Text Book on Power System Engineering“, Dhanpat Rai & Co., 2013   |                |           |
| 2.  | V.K.Mehta, Rohit Meththa, „Principles of Power system“ S.Chand Publications, 4th revised edition 2008.  |                |           |
| 3.  | Y.G. Paithankar and S.R. Bhide, „Fundamentals of Power System Protection“, Prentice Hall of India Pvt. Ltd., New Delhi–110001, 2012   |                |           |
| 4.  | Sunil S. Rao, „Switchgear and Protection“, Khanna publishers, New Delhi, 2013.  |                |           |
| 5.  | Donald Reimert, Protective Relaying for Power generation Systems, CRC Press, Pages 592, 2015  |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://drive.google.com/file/d/1MvUCgdYXz23IyuPsqay-PvWnkoo0DHTa/view">https://drive.google.com/file/d/1MvUCgdYXz23IyuPsqay-PvWnkoo0DHTa/view</a>   |                |           |
| 2.  | <a href="https://www.philadelphia.edu.jo/academics/mlazim/uploads/Power%20System%20protection%20-%20Part%2001.pdf">https://www.philadelphia.edu.jo/academics/mlazim/uploads/Power%20System%20protection%20-%20Part%2001.pdf</a>                                   |                |           |
| 3.  | <a href="https://www.iitr.ac.in/departments/HRE/uploads/modern_hydroelectric_engg/VOL_2/Chapter-3_Electrical_Protection_System.pdf">https://www.iitr.ac.in/departments/HRE/uploads/modern_hydroelectric_engg/VOL_2/Chapter-3_Electrical_Protection_System.pdf</a> |                |           |

|  |  |   |             |                |             |             |             |                  |             |             |              |               |   |                        |              |              |              |  |  |
|--|--|---|-------------|----------------|-------------|-------------|-------------|------------------|-------------|-------------|--------------|---------------|---|------------------------|--------------|--------------|--------------|--|--|
|                   |  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |             |                |             |             |             |                  |             |             |              |               |  |                        |              |              |              |  |  |
| Programme  |  | <b>B.E.</b>   |             | Programme Code |             |             |             |                  |             |             |              | <b>102</b>    |   | Regulation             |              | <b>2019</b>  |              |  |  |
| Department   |  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |             |                |             |             |             |                  |             | Semester    |              |               |   | <b>V</b>               |              |              |              |  |  |
| Course Code  |  | Course Name   |             |                |             |             |             | Periods Per Week |             |             | Credit       | Maximum Marks |   |                        |              |              |              |  |  |
|  |  |   |             |                |             |             |             | L                | T           | P           |              | C             | CA  | ESE                    | Total        |              |              |  |  |
| <b>U19EE518</b>  |  | <b>Power System Analysis</b>  |             |                |             |             |             | 3                | 0           | 0           | 3            | 40            | 60  | 100                    |              |              |              |  |  |
| <b>Course Objective</b>  |  | The students should made to <ul style="list-style-type: none"> <li>• Apply the concept of per unit systems in power system computations.</li> <li>• Understand and apply iterative techniques for power flow analysis</li> <li>• Study the impact of the balanced fault on the system.</li> <li>• Study the impact of the unbalanced fault on the system</li> <li>• Analyze the stability of given network</li> </ul> |             |                |             |             |             |                  |             |             |              |               |   |                        |              |              |              |  |  |
| <b>Course Outcome</b>  |  | At the end of the course, the student should be able to,  |             |                |             |             |             |                  |             |             |              |               |   | <b>Knowledge Level</b> |              |              |              |  |  |
|  |  | <b>CO1:</b> Explain the importance of power system analysis, model various the power system components  |             |                |             |             |             |                  |             |             |              |               |   | K2                     |              |              |              |  |  |
|  |  | <b>CO2:</b> Evaluate the bus powers, line flows and line losses using various power flow methods  |             |                |             |             |             |                  |             |             |              |               |   | K3                     |              |              |              |  |  |
|  |  | <b>CO3:</b> Calculate the symmetrical fault currents and Bus impedance matrix of balanced faults in power system  |             |                |             |             |             |                  |             |             |              |               |   | K3                     |              |              |              |  |  |
|  |  | <b>CO4:</b> .Analyze the different types of unsymmetrical faults  |             |                |             |             |             |                  |             |             |              |               |   | K2                     |              |              |              |  |  |
|  |  | <b>CO5 :</b> Predict the stability of the power system  |             |                |             |             |             |                  |             |             |              |               |   | K2                     |              |              |              |  |  |
| <b>Pre-requisites</b>  |  | Transmission and Distribution   |             |                |             |             |             |                  |             |             |              |               |   |                        |              |              |              |  |  |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |   |             |                |             |             |             |                  |             |             |              |               | <b>CO/PSO Mapping</b>   |                        |              |              |              |  |  |
| <b>COs</b>   |  | <b>Programme Outcomes (POs)</b>   |             |                |             |             |             |                  |             |             |              |               | <b>PSOs</b>   |                        |              |              |              |  |  |
|  |  | <b>PO 1</b>   | <b>PO 2</b> | <b>PO 3</b>    | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b>      | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b>  | <b>PO 12</b>  | <b>PSO1</b>            | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |  |  |
| <b>CO 1</b>  |  | 3   | 2           |                |             | 3           |             |                  |             | 3           | 3            | 2             | 3   |                        | 2            | 2            |              |  |  |
| <b>CO 2</b>  |  | 3   | 3           | 2              |             | 3           |             |                  |             | 3           | 3            | 2             | 3   | 2                      | 2            | 2            |              |  |  |
| <b>CO 3</b>  |  | 3   | 3           | 2              |             | 3           |             |                  |             | 3           | 3            | 2             | 3   | 2                      | 3            | 2            |              |  |  |
| <b>CO 4</b>  |  | 3   | 2           |                |             | 3           |             |                  |             | 3           | 3            | 2             | 3   |                        | 2            | 2            |              |  |  |
| <b>CO 5</b>  |  | 3   | 2           |                | 2           | 3           |             |                  |             | 3           | 3            | 2             | 3   |                        | 2            | 2            |              |  |  |

| <b>Course Assessment Methods</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Direct</b>  |   |                |           |
| 1. Continuous Assessment Test I, II & III  |   |                |           |
| 2. Assignment  |   |                |           |
| 3. End-Semester examinations   |   |                |           |
| <b>Indirect</b>  |   |                |           |
| 1. Course – end Survey   |   |                |           |
| <b>Content of the syllabus</b>   |   |                |           |
| <b>Unit – I</b>  | <b>MODELING OF POWER SYSTEM</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction- Power scenario in India , Need for system planning and operation of Modern Power system- per unit quantities-changing the base of per unit quantities-one line diagram-impedance and reactance diagram-per unit impedances of a generator, transformer, synchronous machines, transmission lines-per phase representation. |   |                |           |
| <b>Unit - II</b>   | <b>LOAD FLOW STUDIES</b>  | <b>Periods</b> | <b>9</b>  |
| The bus admittance matrix, network incidence matrix and Y-bus, node elimination, power flow problem, Gauss-Seidal method, Newton-Raphson method, Numerical solution of power flow problem by GS method, Newton-Raphson method and fast decoupled method ( <b>not more than three buses</b> ).  |   |                |           |
| <b>Unit – III</b>  | <b>SYMMETRICAL FAULTS IN ELECTRICAL SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Importance of short circuit analysis - assumptions in fault analysis - analysis using Thevenin's theorem -Z-bus building algorithm - fault analysis using Z-bus - computations of short circuit capacity, postfault voltage and currents   |   |                |           |
| <b>Unit - IV</b>   | <b>UNSYMMETRICAL FAULTS IN ELECTRICAL SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Synthesis of unsymmetrical phasors from their symmetrical components - sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. single line-to-ground fault, line-to-line fault, double line-to-ground fault.  |   |                |           |
| <b>Unit – V</b>  | <b>STABILITY ANALYSIS</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction to power system stability-Swing equation and its solution method (step by step) -Equal area criterion -Factors affecting stability and methods of improving stability.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Grainger John J.& Stevenson W.D, "Power System Analysis", 1st Edition, Tata McGraw- Hill, New Delhi, 2017.  |                |           |
| 2.   | Hadi Saadat, Power System Analysis, PSA Publishers, New Delhi, 2013.  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Wadhwa C.L , "Electrical Power Systems", 7th Edition, New Age International Publishers Pvt. Ltd, New Delhi, 2011  |                |           |
| 2.   | I.J. Nagarath, D.P. Kothari, Modern Power System Analysis, Tata McGraw Hill Publishing Company, New Delhi, 2013.  |                |           |
| 3.   | P.Kundur, Power System Stability and Control, Tata McGraw Hill Book Company, New Delhi, 2013.   |                |           |
| 4.   | P.Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, Electrical Power Systems Analysis, Security and Deregulation, PHI Learning Private Limited, New Delhi, 2012 |                |           |
| 5.   | Charles A. Gross, Power System Analysis, Wiley India Pvt Ltd, Second edition, 2010  |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/117/105/117105140/">https://nptel.ac.in/courses/117/105/117105140/</a>   |                |           |
| 2.   | <a href="https://www.youtube.com/watch?v=dWbZlyKW0As">https://www.youtube.com/watch?v=dWbZlyKW0As</a>   |                |           |
| 3.   | <a href="https://freevideolectures.com/course/2353/power-systems-analysis">https://freevideolectures.com/course/2353/power-systems-analysis</a>                           |                |           |



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|   |  |                  |            |            |             |               |                 |     |       |
|---|--|------------------|------------|------------|-------------|---------------|-----------------|-----|-------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |     |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   | <b>V</b>    |               |                 |     |       |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                 |     |       |
|   |  | L                | T          | P          |             | C             | CA              | ESE | Total |
| <b>U19EE519</b>   | <b>Power Electronics</b>   | 3                | 0          | 0          | 3           | 40            | 60              | 100 |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Understanding of modern power semiconductor devices,</li> <li>• Understanding of various important topologies of power converter circuits for specific types of applications.</li> <li>• Understand and analyze non-linear circuits involving power electronic converters.</li> </ul> |                  |            |            |             |               |                 |     |       |
| <b>Course Outcome</b>   | At end of the course the students will be able to  |                  |            |            |             |               | Knowledge Level |     |       |
|   | <b>CO1:</b> Choose various power semiconductor devices based on their construction and characteristics   |                  |            |            |             |               | K2              |     |       |
|   | <b>CO2:</b> Evaluate the input and output parameters of controlled rectifiers with R, RL and RLE Load.   |                  |            |            |             |               | K3              |     |       |
|   | <b>CO3:</b> Determine the principle of operation of DC to DC converters  |                  |            |            |             |               | K3              |     |       |
|   | <b>CO4:</b> Analyze the different types of inverters and their working principle   |                  |            |            |             |               | K4              |     |       |
| <b>CO5:</b> Interpret the principle of operation of cycloconverter and ac voltage controllers |  |                  |            |            |             | K4            |                 |     |       |
| <b>Pre-requisites</b>   | -  |                  |            |            |             |               |                 |     |       |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |                          |      |      |      |      |      |      |      |      |       |       | CO/PSO Mapping |       |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|----------------|-------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       | PSOs           |       |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12          | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3                        | 3    | 3    |      | 1    |      |      |      |      |       | 2     | 2              | 2     | 1     | 2     | 1     |
| CO 2  | 3                        | 3    | 3    |      | 2    |      |      |      |      |       | 2     | 2              | 2     | 1     | 2     | 1     |
| CO 3  | 3                        | 3    | 3    |      | 2    |      |      |      |      |       | 2     | 3              | 2     | 1     | 2     | 1     |
| CO 4  | 3                        | 3    | 3    |      | 1    |      |      |      |      |       | 2     | 3              | 2     | 1     | 2     | 1     |
| CO 5  | 3                        | 3    | 3    |      | 1    |      |      |      |      |       | 2     | 3              | 2     | 1     | 2     | 1     |

### Course Assessment Methods



#### Direct

1. Continuous Assessment Test I, II &III
2. Assignment
3. End-Semester examinations

#### Indirect



1. Course – end survey

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>POWER SEMI-CONDUCTOR DEVICES</b>   | <b>Periods</b> | <b>9</b>  |
| Construction, Operation Static and Dynamic Characteristics of Power diodes - operation of SCR, GTO, TRIAC, MOSFET, IGBT, IGCT.  |   |                |           |
| <b>Unit - II</b>  | <b>PHASE-CONTROLLED CONVERTERS</b>  | <b>Periods</b> | <b>9</b>  |
| <b>Single phase converter:</b> Half wave, Half controlled bridge converter and full controlled bridge converter with R, RL, RLE Load - <b>Three phase bridge converter:</b> Half wave and full wave converter with R, RL and RLE Load – Estimation of average & RMS values of load voltage, load current for R load (both single phase and three phase) - Dual converter. |   |                |           |
| <b>Unit – III</b>   | <b>DC-DC CONVERTERS</b>   | <b>Periods</b> | <b>9</b>  |
| Fly back converters – forward converters-Switching Mode Regulators: Buck – Boost – Buck Boost Converters – Cuk Converters- SEPIC Converter – Applications.  |   |                |           |
| <b>Unit - IV</b>  | <b>DC-AC CONVERTERS</b>   | <b>Periods</b> | <b>9</b>  |
| Types of inverters – operation of Single phase and three phase (120°, 180°) voltage source inverter modes analysis with star connected R load – operation of single phase current source inverter – Multilevel inverters – Voltage control of Single phase inverters – harmonic reduction techniques-UPS-SMPS.  |   |                |           |
| <b>Unit – V</b>   | <b>AC-AC CONVERTERS</b>   | <b>Periods</b> | <b>9</b>  |
| AC Voltage Controllers : Single phase voltage regulators – half wave and full wave with R, RL loads – sequence control of AC regulators – two stage sequence regulator with R, RL load – Introduction to Three phase regulators (no analysis). Single phase and three phase Cycloconverters-Matrix converters   |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Rashid, M.H, „Power Electronics - Circuits, Devices and Applications“, Pearson Education, 3rd Edition, New Delhi, 2017.   |                |           |
| 2.  | M.D.SinghandK.B.Khanchandani,„PowerElectronics“,TataMcGrawHillsPublishing Company Limited, 2nd Edition, 2019.   |                |           |
| <b>References</b>   |   |                |           |
| 1.  | DanielW.Hart,„PowerElectronics“,2 <sup>nd</sup> EditionbyMcGrawHillEducation,2017   |                |           |
| 2.  | DavidAllanBradley,„PowerElectronics“,2 <sup>nd</sup> EditionbyCRCPress,1995   |                |           |
| 3.  | PhilipT.Krein,„ElementsofPowerElectronics“,OxfordUniversityPress,1stEdition,2012.   |                |           |
| 4.  | Vedam Subramaniam, „Power Electronics“, New Age International (P) Ltd Publishers, 2001  |                |           |
| 5.  | NedMohan,ToreM.Undeland,WilliamP.Robbins,„PowerElectronics“,JohnWiley&Sons Publications , 3rd edition, 2006   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://mrcet.com/downloads/digital_notes/EEE/31082020/Power%20Electronics.pdf">https://mrcet.com/downloads/digital_notes/EEE/31082020/Power%20Electronics.pdf</a> |                |           |
| 2.  | <a href="https://drive.google.com/file/d/1xKdq5ReLaNURtbfdIX6LtGidpWy8hhM8/view">https://drive.google.com/file/d/1xKdq5ReLaNURtbfdIX6LtGidpWy8hhM8/view</a>                 |                |           |
| 3.  | <a href="https://www.sciencedirect.com/science/article/pii/S2096511718300720">https://www.sciencedirect.com/science/article/pii/S2096511718300720</a>                       |                |           |
| 4.  | <a href="https://www.elprocus.com/dc-to-ac-converter-circuit-working-applications/">https://www.elprocus.com/dc-to-ac-converter-circuit-working-applications/</a>           |                |           |
| 5.  | <a href="https://nptel.ac.in/courses/108/105/108105066/">https://nptel.ac.in/courses/108/105/108105066/</a>   |                |           |

|  |  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
|--|--|------------------|-------------|-------------|-------------|---|-----------------|-------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |             |  |                 |             |             |              |              |                       |              |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code   |             |             | <b>102</b>  | Regulation  | <b>2019</b>     |             |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             | Semester    |   | <b>V</b>        |             |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit      | Maximum Marks   |                 |             |             |              |              |                       |              |              |              |              |
|  |  | L                | T           | P           |             | C   | CA              | ESE         | Total       |              |              |                       |              |              |              |              |
| <b>U19EE520</b>  | <b>Microprocessors and Microcontrollers laboratory</b>   | 0                | 0           | 4           | 2           | 60  | 40              | 100         |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>• Provide training on programming of microprocessors and microcontrollers</li> <li>• Understand the interface requirements.</li> <li>• Simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.</li> </ul> |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | On completion of the course the students will be able to   |                  |             |             |             |   | Knowledge Level |             |             |              |              |                       |              |              |              |              |
|  | <b>CO1:</b> Understand and apply computing platform and software for engineering problems  |                  |             |             |             |   | K4              |             |             |              |              |                       |              |              |              |              |
|  | <b>CO2:</b> Programming logics for code conversion.  |                  |             |             |             |   | K4              |             |             |              |              |                       |              |              |              |              |
|  | <b>CO3:</b> Acquire knowledge on A/D and D/A.  |                  |             |             |             |   | K3              |             |             |              |              |                       |              |              |              |              |
|  | <b>CO4:</b> Understand basics of serial communication.   |                  |             |             |             |   | K4              |             |             |              |              |                       |              |              |              |              |
| <b>CO5:</b> Understand and impart knowledge in DC and AC motor interfacing.                        |  |                  |             |             |             | K6  |                 |             |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  | -  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |  |                  |             |             |             |   |                 |             |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>COs</b>   | <b>Programme Outcomes (POs)</b>  |                  |             |             |             |   |                 |             |             |              |              |                       | <b>PSOs</b>  |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b>     | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 3                | 3           | 3           | 2           |   |                 |             |             | 3            | 2            | 1                     | 3            | 3            | 3            | 3            |
| <b>CO 2</b>  | 3  | 2                | 3           | 3           | 3           |   |                 |             |             | 3            | 2            | 1                     | 3            | 3            | 3            | 3            |
| <b>CO 3</b>  | 2  | 3                | 3           | 3           | 2           |   |                 |             |             | 3            | 2            | 1                     | 3            | 3            | 3            | 3            |
| <b>CO 4</b>  | 2  | 2                | 3           | 3           | 3           |   |                 |             |             | 3            | 2            | 1                     | 3            | 3            | 3            | 3            |
| <b>CO 5</b>  | 3  | 3                | 3           | 3           | 3           |   |                 |             |             | 3            | 2            | 1                     | 3            | 3            | 3            | 3            |
| <b>Course Assessment Methods</b>   |  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
| 1. Pre lab and post lab test<br>2. Record mark<br>3. End-Semester examinations                     |  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |
| 1.Course - end survey  |  |                  |             |             |             |   |                 |             |             |              |              |                       |              |              |              |              |

| <b>Content of the syllabus</b> |   |                       |   |
|--------------------------------|---|-----------------------|---|
| <b>S.No</b>                    | <b>LIST OF EXPERIMENTS</b>  | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
| 1.                             | Simple arithmetic operations using 8085: addition / subtraction / multiplication /division.   | CO1                   | PO1,PO3, PSO1,PSO4                                    |
| 2.                             | Programming with control instructions:<br>a. Sorting and searching of numbers.<br>b. Counting of odd and even numbers in a block of data.<br>c. Counting of positive and negative numbers in a block of data<br>d. Code conversions | CO2                   | PO1,PO3, PSO1, PSO4                                   |
| 3.                             | Interface Experiments: with8085 A/D Interfacing. and D/A Interfacing  | CO3                   | PO2,PO3, PO10, PSO1, PSO4                             |
| 4.                             | Interfacing Traffic light controller with8085.  | CO1                   | PO1,PO3, PSO1,PSO4                                    |
| 5.                             | Serial communication interfacing with8085.  | CO4                   | PO1,PO4, PSO1,PSO4                                    |
| 6.                             | Read a key, interface display using 8085.   | CO4                   | PO3,PO4,PO5 ,PSO1,PSO4                                |
| 7.                             | Programming Practices with Simulators/Emulators/open source   | CO1                   | PO1,PO3, PO4,PSO1, PSO4                               |
| 8.                             | Simple arithmetic operations using 8051: addition / subtraction / multiplication /division.   | CO1                   | PO1,PO3, PO4 PSO1,PSO4                                |
| 9.                             | Square and Cube program, Find 2,,s complement of a number using8051   | CO2                   | PO1,PO3, PSO1,PSO4                                    |
| 10.                            | Programming I/O Port and timer of8051<br>a. study on interface with A/D and D/A<br>b. Study on interface with DC and AC motors<br>c. Firing pulse generation using8051  | CO5                   | PO1,PO3, PO4, PSO1,PSO4                               |
| <b>Total periods</b>           |   | <b>45</b>             |   |





|   |   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
|---|---|------------------|-----|--------|-----|---------------|---|----------|-----------------|------|------|----------------------|--------------|------|------|------|
|          | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |     |        |     |               |  |          |                 |      |      |                      |              |      |      |      |
| Programme   | <b>B.E.</b>   | Programme Code   |     |        |     | <b>102</b>    | Regulation <b>2019</b>  |          |                 |      |      |                      |              |      |      |      |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |     |        |     |               | Semester  | <b>V</b> |                 |      |      |                      |              |      |      |      |
| Course Code   | Course Name   | Periods Per Week |     | Credit |     | Maximum Marks |   |          |                 |      |      |                      |              |      |      |      |
|   |   | L                | T   | P      | C   | CA            | ESE   | Total    |                 |      |      |                      |              |      |      |      |
| <b>U19EE521</b>   | <b>Control Systems and Instrumentation Laboratory</b>   | 0                | 0   | 4      | 2   | 60            | 40  | 100      |                 |      |      |                      |              |      |      |      |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Provide knowledge on basics instrumentation</li> <li>• Analysis and design of control system along with basics of instrumentation</li> </ul> |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |     |        |     |               |   |          | Knowledge level |      |      |                      |              |      |      |      |
|   | <b>CO1:</b> Evaluate the transfer function of a given AC and DC servo motor   |                  |     |        |     |               |   |          | K4              |      |      |                      |              |      |      |      |
|   | <b>CO2:</b> Determine the performance of first and second order systems in time domain  |                  |     |        |     |               |   |          | K3              |      |      |                      |              |      |      |      |
|   | <b>CO3:</b> Understand about the stability analysis with DC and AC position control systems.  |                  |     |        |     |               |   |          | K2              |      |      |                      |              |      |      |      |
|   | <b>CO4:</b> Understand the Digital simulation of first order and second order systems   |                  |     |        |     |               |   |          | K2              |      |      |                      |              |      |      |      |
|   | <b>CO5:</b> Understand the basic concepts of bridge networks.   |                  |     |        |     |               |   |          | K2              |      |      |                      |              |      |      |      |
| <b>Pre-requisites</b>   | -   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
| <b>CO/PO Mapping</b><br>(3/2/1 indicates strength of correlation)3-Strong,2-Medium,1-Weak |   |                  |     |        |     |               |   |          |                 |      |      | <b>CO/PO Mapping</b> |              |      |      |      |
| <b>COs</b>  | Programme outcomes(POs)   |                  |     |        |     |               |   |          |                 |      |      |                      | <b>PSO s</b> |      |      |      |
|   | PO1   | PO2              | PO3 | PO4    | PO5 | PO6           | PO7   | PO8      | PO9             | PO10 | PO11 | PO12                 | PSO1         | POS2 | POS3 | POS4 |
| <b>CO1</b>  | 3   | 2                | 2   |        | 1   | 1             |   |          | 1               |      | 1    | 1                    | 3            | 2    |      | 1    |
| <b>CO2</b>  | 3   | 2                | 2   |        | 1   | 1             |   |          | 1               |      | 1    | 1                    | 3            | 2    |      | 1    |
| <b>CO3</b>  | 3   | 2                | 2   |        | 1   | 1             |   |          | 1               |      | 1    | 1                    | 3            | 2    |      | 1    |
| <b>CO4</b>  | 3   | 2                | 2   |        | 1   | 1             |   |          | 1               |      | 1    | 1                    | 3            | 2    |      | 2    |
| <b>CO5</b>  | 3   | 2                | 2   |        | 1   | 1             |   |          | 1               |      | 1    | 1                    | 3            | 2    |      | 2    |
| <b>Course Assessment Methods</b>  |   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
| <b>Direct</b>   |   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
| 1. Prelab and post labtest<br>2. Recordmark<br>3. End-Semester examinations               |   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
| <b>Indirect</b>   |   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |
| 1. Course - end survey  |   |                  |     |        |     |               |   |          |                 |      |      |                      |              |      |      |      |

**Content of the Syllabus**

| <b>S.No</b>          | <b>LIST OF EXPERIMENTS</b>   | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
|----------------------|--|-----------------------|---|
| 1.                   | Determination of transfer functions of DC Servomotor.                | CO1                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| 2.                   | Determination of transfer functions of AC Servomotor.                | CO1                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| 3.                   | Analog simulation of Type - 0 and Type – 1 system.                   | CO2                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| 4.                   | Stability analysis of linear systems.                                | CO2                   | PO1,PO2,PO3, PSO1, PSO3,PSO4                          |
| 5.                   | DC and AC position control systems.                                  | CO3                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| 6.                   | Digital simulation of first and second systems.                      | CO4                   | PO1,PO2,PO3,PO5<br>PSO1,PSO2,PSO3,PSO4                |
| 7.                   | Linear Variable Differential Transformer (LVDT).                     | CO5                   | PO1,PO2,PO3, PSO1,PSO4                                |
| 8.                   | Measurement of Low Resistance by Kelvin's Double Bridge Method.      | CO5                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| 9.                   | Measurement of Self Inductance and Capacitance using Bridges.        | CO5                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| 10.                  | Measurement of Power in a single phase circuit by using CTs and PTs. | CO5                   | PO1,PO2,PO3, PSO1,PSO3,PSO4                           |
| <b>Total periods</b> |  |                       | <b>45</b>   |

Signature of the BOS Chairman, EEE

|   |   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
|---|---|------------------|------|------|------------|---------------|---|-------|------|-------|-------|-------|-----------------------|-------|-------|-------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |      |      |            |               |  |       |      |       |       |       |                       |       |       |       |
| Programme   | <b>B.E.</b>   | Programme Code   |      |      | <b>102</b> | Regulation    | <b>2019</b>   |       |      |       |       |       |                       |       |       |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |      |      | Semester   |               | <b>VI</b>   |       |      |       |       |       |                       |       |       |       |
| Course Code   | Course Name   | Periods Per Week |      |      | Credit     | Maximum Marks |   |       |      |       |       |       |                       |       |       |       |
|   |   | L                | T    | P    | C          | CA            | ESE   | Total |      |       |       |       |                       |       |       |       |
| <b>U19EE622</b>   | <b>Generation of Electrical Energy</b>  | 3                | 0    | 0    | 3          | 40            | 60  | 100   |      |       |       |       |                       |       |       |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>Understand the various concepts behind load demand</li> <li>Understand the energy production by conventional generation schemes.</li> <li>Analyze the solar power system and its application.</li> <li>Introduce the concepts of Wind Energy and its utilization.</li> <li>Understand about micro grid and its modes of operation</li> </ul> |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |      |      |            |               | Knowledge level   |       |      |       |       |       |                       |       |       |       |
|   | <b>CO1:</b> Classify different types of loads and recognize the load demand- supply curve.  |                  |      |      |            |               | K1,K2   |       |      |       |       |       |                       |       |       |       |
|   | <b>CO2:</b> Identify the areas of agreement and disagreement in safety aspects and environmental concern of conventional power generation schemes.  |                  |      |      |            |               | K2  |       |      |       |       |       |                       |       |       |       |
|   | <b>CO3:</b> Design and develop solar PV based grid tied, off grid and hybrid systems for domestic applications.   |                  |      |      |            |               | K3,K4   |       |      |       |       |       |                       |       |       |       |
|   | <b>CO4:</b> Examine the possibilities of wind energy systems in the particular locality.  |                  |      |      |            |               | K2  |       |      |       |       |       |                       |       |       |       |
| <b>CO5:</b> Examine the solar PV, wind, fuel cell and battery sources of energy for micro-grid installation for a given requirements. |   |                  |      |      |            | K2            |   |       |      |       |       |       |                       |       |       |       |
| <b>Pre-requisites</b>   | -   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak                                    |   |                  |      |      |            |               |   |       |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
| <b>Cos</b>  | Programme Outcomes (POs)  |                  |      |      |            |               |   |       |      |       |       |       | PSOs                  |       |       |       |
|   | PO 1  | PO 2             | PO 3 | PO 4 | PO 5       | PO 6          | PO 7  | PO 8  | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3   | 3                | 3    |      |            | 3             | 2   |       |      |       |       | 3     | 3                     |       | 3     | 3     |
| CO 2  | 3   | 3                |      |      |            | 3             | 3   |       |      |       |       | 3     | 3                     | 2     |       |       |
| CO 3  | 3   | 3                | 3    | 3    |            | 3             | 3   |       |      |       |       | 3     | 3                     | 2     | 3     | 3     |
| CO 4  | 3   | 3                |      |      |            | 3             | 3   |       |      |       |       | 3     | 3                     |       | 3     | 3     |
| CO 5  | 3   | 3                |      |      |            | 3             | 2   |       |      |       |       | 3     | 3                     |       |       |       |
| <b>Course Assessment Methods</b>  |   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
| <b>Direct</b>   |   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
| 1. Continuous Assessment Test I, II &III<br>2. Assignment<br>3. End-Semester examinations   |   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
| <b>Indirect</b>   |   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |
| 1. Course - end survey  |   |                  |      |      |            |               |   |       |      |       |       |       |                       |       |       |       |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>LOAD DEMAND</b>  | <b>Periods</b> | <b>9</b>  |
| Demand for Electric Power – Load Curves and Load Curve Analysis – Diversity and Plant factors - Reliability Evaluation – Outages, Causes and Interruptions – Cost versus Reliability – Short and Long range planning.  |   |                |           |
| <b>Unit - II</b>   | <b>CONVENTIONAL GENERATION SCHEMES</b>  | <b>Periods</b> | <b>9</b>  |
| Hydroelectric power plants - Pumped storage plants- Thermal power plants: Steam power stations, Gas turbine stations and Diesel generators – Nuclear power plants – Safety aspects – Environmental concerns.   |   |                |           |
| <b>Unit – III</b>  | <b>SOLAR PV SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Solar radiation and measurement -Block diagram of solar photo voltaic system- Solar PV Cell- Characteristics and Types - Arrays and Panels - DC power conditioners - Maximum power point tracking algorithms - AC power conditioners - Synchronized operation with grid supply – Standalone PV System. Solar PV Applications: Water pumping and Street lighting. |   |                |           |
| <b>Unit - IV</b>   | <b>WIND ENERGY SYSTEMS</b>  | <b>Periods</b> | <b>9</b>  |
| Basic principle of wind energy conversion - Nature of wind power in the wind - Site selection considerations- Components of Wind Energy Conversion System (WECS) - Classification of WECS - Schemes of electrical generation. Applications – Water pumping and Village electrification.  |   |                |           |
| <b>Unit – V</b>  | <b>COGENERATION AND MICROGRID</b>   | <b>Periods</b> | <b>9</b>  |
| Distributed generation versus Traditional power systems – Concepts of micro grid – Additional sources of micro grids: Biomass and Fuel cells – Structure and Configuration of AC and DC micro grid – Modes of operation and Control of micro grid: Grid connected and Islanded mode.   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | C.L.Wadhwa, "Electrical Power Systems", New Age International, 2007.  |                |           |
| 2.   | Mukund R. Patel, "Wind and Solar Power Systems", CRC Press, New York, 2009  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Digambar M. Tagare, "Electricity Power Generation: The Changing Dimensions", John Wiley & Sons, 2011  |                |           |
| 2.   | Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI, Delhi, 2015  |                |           |
| 3.   | Adolf Goetzberger, Volker Hoffmann, "Photovoltaic Solar Energy Generation", Springer- Verlag Berlin Heidelberg, 2005  |                |           |
| 4.   | P Breeze, "Power Generation Technologies", Elsevier, 2nd Edition, 2014  |                |           |
| 5.   | S.Chowdhury and P.Crossley, "Microgrids and Active Distribution Networks", Institution of Engineering and Technology (IET Press), 2010.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://www.google.com/search?q=generation+of+electrical+energy&amp;oq=generation+of+electrical+energy&amp;aqs=chrome..69i57j0j46j0l5.26017j0j7&amp;sourceid=chrome&amp;ie=UTF-8">https://www.google.com/search?q=generation+of+electrical+energy&amp;oq=generation+of+electrical+energy&amp;aqs=chrome..69i57j0j46j0l5.26017j0j7&amp;sourceid=chrome&amp;ie=UTF-8</a> |                |           |
| 2.   | <a href="https://www.google.com/search?q=solar+pv+systems&amp;oq=SOLAR+PV+SYSTEMS&amp;aqs=chrome.0.018.3729j0j9&amp;sourceid=chrome&amp;ie=UTF-8">https://www.google.com/search?q=solar+pv+systems&amp;oq=SOLAR+PV+SYSTEMS&amp;aqs=chrome.0.018.3729j0j9&amp;sourceid=chrome&amp;ie=UTF-8</a>   |                |           |
| 3.   | <a href="https://en.wikipedia.org/wiki/Electricity_generation">https://en.wikipedia.org/wiki/Electricity_generation</a>   |                |           |



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|                         |  |                  |            |            |             |               |    |                 |
|-------------------------|--|------------------|------------|------------|-------------|---------------|----|-----------------|
| Programme               | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |    |                 |
| Department              | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   | <b>VI</b>   |               |    |                 |
| Course Code             | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |    |                 |
|                         |  | L                | T          | P          |             | C             | CA | ESE             |
| <b>U19EE623</b>         | <b>Power System operation and Control</b>  | 3                | 0          | 0          | 3           | 40            | 60 | 100             |
| <b>Course Objective</b> | The students should made to <ul style="list-style-type: none"> <li>Learn the voltage control methods and reactive power compensation techniques.</li> <li>Analyze the unit commitment and economic dispatch scheduling.</li> <li>Learn the control methods and energy management system of power system network</li> </ul> |                  |            |            |             |               |    |                 |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               |    | Knowledge Level |
|                         | <b>CO1:</b> understand the voltage control methods and reactive power compensation techniques.   |                  |            |            |             |               |    | K2              |
|                         | <b>CO2:</b> Analyze the unit commitment problems.  |                  |            |            |             |               |    | K4              |
|                         | <b>CO3:</b> Analyze the economic dispatch problems.  |                  |            |            |             |               |    | K4              |
|                         | <b>CO4:</b> Understand the control methods and energy management system of power system network  |                  |            |            |             |               |    | K2              |
| <b>Pre-requisites</b>   | <b>CO5:</b> Apply the state estimation in power system network.  |                  |            |            |             |               |    | K3              |
|                         | Power System Analysis  |                  |            |            |             |               |    |                 |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3                        | 3    | 2    | 2    | -    | -    | -    | -    | -    | -     | 2     | 2     | 2              | -     | 2     | 2     |
| CO 2  | 3                        | 3    | 3    | 3    | -    | -    | -    | -    | -    | -     | 2     | 2     | 2              | -     | 3     | 3     |
| CO 3  | 3                        | 3    | 3    | 3    | -    | -    | -    | -    | -    | -     | 2     | 3     | 2              | -     | 3     | 3     |
| CO 4  | 3                        | 3    | 3    | 3    | -    | -    | -    | -    | -    | -     | 2     | 3     | 2              | -     | 3     | 3     |
| CO 5  | 3                        | 3    | 2    | 2    | -    | -    | -    | -    | -    | -     | 2     | 3     | 2              | -     | 3     | 3     |

**Course Assessment Methods**

**Direct**

1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

**Indirect**

1. Course – end survey

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>REACTIVE POWER AND VOLTAGE CONTROL</b>   | <b>Periods</b> | <b>9</b>  |
| Production and absorption of reactive power – Methods of voltage control – Shunt reactors – Shunt Capacitors – Series capacitors – Synchronous condensers – Static VAR systems – Principles of Transmission system compensating– Modeling of reactive compensating devices.   |   |                |           |
| <b>Unit - II</b>  | <b>GENERATION SCHEDULING</b>  | <b>Periods</b> | <b>9</b>  |
| The Economic dispatch problem – Thermal system dispatch problem – Thermal system dispatching with network losses considered – lambda – iteration method – Gradient method of economic dispatch – Incremental losses and penalty factors – Hydro thermal scheduling using DP.  |   |                |           |
| <b>Unit – III</b>   | <b>UNIT COMMITMENT</b>  | <b>Periods</b> | <b>9</b>  |
| Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Other constraints –Solution using priority list method, Dynamic programming method – Forward DP approach, lagrangian relaxation method.  |   |                |           |
| <b>Unit - IV</b>  | <b>CONTROL OF POWER SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Review of AGC and reactive power control system operating states by security control functions – Monitoring – Energy control centre – SCADA System – Functions - monitoring data acquisition and controls – EMS System  |   |                |           |
| <b>Unit – V</b>   | <b>STATE ESTIMATION</b>   | <b>Periods</b> | <b>9</b>  |
| Maximum likelihood weighted least squares estimation: Concepts – Matrix formulation – Example for weighted least squares states estimation :state estimation of an AC network :Typical results of states estimation on an AC network – States estimation by orthogonal decomposition algorithm – Introduction to advanced topics : detection and identification of bad measurements, estimation of quantities not being measured , network observability and pseudo measurements – Application of power systems state estimation. |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1   | Kothari.D.P and Nagrath.I.J, “Modern Power System Analysis”, Tata McGraw Hill Publishing Company Limited, New Delhi, 4th Edition, 2011.   |                |           |
| 2   | Chakrabarti and Halder, “Power System Analysis: Operation and Control”, Prentice Hall of India,3rd Edition, 2010.   |                |           |
| <b>References</b>   |   |                |           |
| 1   | Kundur.P, “Power System Stability and Control”, Tata McGraw Hill Publisher, USA, 2006.  |                |           |
| 2   | Hadi Saadat, “Power System Analysis”, 11th Reprint, Tata McGraw Hill Publisher, USA,2007.   |                |           |
| 3   | Grigsby.L.L, “The Electric Power Engineering, Hand Book”, CRC Press and IEEE Press, 2001.   |                |           |
| 4   | Olle.I.Elgerd, “Electric Energy Systems theory - An introduction”, Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.   |                |           |
| 5   | Allen J. Wood and Bruce F. Wollenberg, “Power Generation, Operation and Control”, John Wileyand Sons Inc., 2nd Edition, 2006.   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1   | <a href="https://www.vidyarthiplus.com/vp/Thread-EE2401-Power-System-Operation-and-Control-Hand-Written-Notes-Lavanya-Edition#.XdUSrNizbcs">https://www.vidyarthiplus.com/vp/Thread-EE2401-Power-System-Operation-and-Control-Hand-Written-Notes-Lavanya-Edition#.XdUSrNizbcs</a> |                |           |
| 2   | <a href="http://studentsfocus.com/ee8702-psoc-notes-power-system-operation-and-control-notes-eee-7th-sem/">http://studentsfocus.com/ee8702-psoc-notes-power-system-operation-and-control-notes-eee-7th-sem/</a>   |                |           |
| 3   | <a href="https://nptel.ac.in/courses/108101040/">https://nptel.ac.in/courses/108101040/</a>   |                |           |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(Autonomous Institution, Affiliated to Anna University ,Chennai)  
Elayampalayam, Tiruchengode – 637 205



|   |   |                  |            |            |             |               |    |                        |
|---|---|------------------|------------|------------|-------------|---------------|----|------------------------|
| Programme   | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |    |                        |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>VI</b>   |               |    |                        |
| Course Code   | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |    |                        |
|   |   | L                | T          | P          |             | C             | CA | ESE                    |
| <b>U19HS603</b>   | <b>Principles of Management</b>   | 3                | 0          | 0          | 3           | 40            | 60 | 100                    |
| <b>Course Objective</b>   | The students should be able to <ul style="list-style-type: none"> <li>• Understand the functions and evolution of Management</li> <li>• Understand the planning process and steps involved in organization.</li> <li>• Organize and learn delegation of authority.</li> <li>• Understand the effective and barriers of communication in the organization</li> <li>• Understand the system and process of effective controlling in the organization</li> </ul> |                  |            |            |             |               |    |                        |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |            |            |             |               |    | <b>Knowledge Level</b> |
|   | <b>CO1:</b> Understand the functions and responsibilities of managers and management.   |                  |            |            |             |               |    | K1                     |
|   | <b>CO2:</b> Understand the planning process in the organization   |                  |            |            |             |               |    | K2                     |
|   | <b>CO3:</b> Understand the organization structure and recruitment process   |                  |            |            |             |               |    | K2                     |
|   | <b>CO4:</b> Understand the effective and barriers communication in the organization   |                  |            |            |             |               |    | K3                     |
| <b>CO5:</b> Analyse, isolate issues and formulate best control methods. |   |                  |            |            |             |               | K2 |                        |
| <b>Pre-requisites</b>   | -   |                  |            |            |             |               |    |                        |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   |                          |      |      |      |      | 2    |      | 2    | 2    | 1     | 3     | 1     | 1                     |       |       | 1     |
| CO 2   |                          |      |      |      |      | 2    |      | 2    | 2    |       | 2     | 1     |                       | 2     | 1     | 1     |
| CO 3   |                          |      |      |      |      | 2    |      | 2    | 2    |       |       | 1     | 1                     |       |       | 1     |
| CO 4   |                          |      |      |      |      | 2    |      | 2    | 2    | 3     | 2     | 1     | 1                     |       |       | 2     |
| CO 5   |                          |      |      |      |      | 2    |      | 2    | 2    |       |       | 1     | 2                     |       |       | 1     |

**Course Assessment Methods**

**Direct**



1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

**Indirect**

1. Course – end Survey

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODCUTION TO MANAGEMENT</b>   | <b>Periods</b> | <b>9</b>  |
| Definition, Functions, Process, Scope and Significance of Management-Nature of Management and Managerial Roles,-Managerial Skills and Activities-Management and Administration.- Evolution and ApproachesofManagementThought-FunctionsofManagement-SignificanceofValuesandEthicsin Management  |   |                |           |
| <b>Unit - II</b>   | <b>PLANNING</b>   | <b>Periods</b> | <b>9</b>  |
| Nature, Objectives, Types and Levels, Process of Planning, Planning Premises and Forecasting, MBO,- Strategic Management – Planning Tools and Techniques – Decision making steps and process.  |   |                |           |
| <b>Unit – III</b>  | <b>ORGANIZING</b>   | <b>Periods</b> | <b>9</b>  |
| Basic concept-Forms of Organizational Structure-Combining Jobs: Departmentalization, Span of Control, Delegation of Authority, Authority & Responsibility- Line and Staff Relationship- Staffing-. Effective Organizing-Organizational Structure- Formal and Informal Organizations- Manpower Planning-Job Design- Recruitment & Selection-Training & Development-Performance Appraisal. |   |                |           |
| <b>Unit - IV</b>   | <b>DIRECTING</b>  | <b>Periods</b> | <b>9</b>  |
| Effective Directing-Supervision and Motivation-Different Theories of Motivation-Job Satisfaction-Concept of Leadership- Theories and Styles-Communication Process, Channels and Barriers-Effective Communication.  |   |                |           |
| <b>Unit – V</b>  | <b>CONTROLLING AND COORDINATING</b>   | <b>Periods</b> | <b>9</b>  |
| System and process of controlling -Elements of Managerial Control-Controlling Techniques- .Coordination Concept, Importance, Principles and Techniques of Coordination, Concept of Managerial Effectiveness.   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Harold Koontz, Heinz Wehrich, Mark V. Cannice (2020). An International, Innovation and Leadership Perspective (11th ed.), Tata McGraw Hills, New Delhi.   |                |           |
| 2.   | Ghuman, K & Aswathapa, K, (2017). Management concepts and cases (10th ed.), Tata McGraw Hills, New Delhi.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Robbins, S. (2017). Management, (13th ed.), Pearson Education, New Delhi.   |                |           |
| 2.   | Telsan, M.T. (2016). Industrial and Business Management, (4th ed.), S. Chand, New Delhi.  |                |           |
| 3.   | Ramaswamy,I. (2011). Principles of Business Management, (8th ed.), Himalaya Publishing House, New Delhi.  |                |           |
| 4.   | Mahadevan, B., Operations Management, Theory and Practice, Pearson Education Asia, 2009.  |                |           |
| 5.   | Hicks, Management: Concepts and Applications, Cengage Learning, 2007.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/110/105/110105146/">https://nptel.ac.in/courses/110/105/110105146/</a>   |                |           |
| 2.   | <a href="https://aits-tpt.edu.in/wp-content/uploads/2018/08/MS-NOTES-UNIT-1-2-3.pdf">https://aits-tpt.edu.in/wp-content/uploads/2018/08/MS-NOTES-UNIT-1-2-3.pdf</a>   |                |           |
| 3.   | <a href="https://www.businessmanagementideas.com/management/principles-of-management-lecture-notes/7447">https://www.businessmanagementideas.com/management/principles-of-management-lecture-notes/7447</a> |                |           |





|  |  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
|--|--|------------------|-------------|-------------|-------------|---|-------------|-----------------|-------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |             |  |             |                 |             |              |              |              |                       |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code   |             |             | <b>102</b>  | Regulation  | <b>2019</b> |                 |             |              |              |              |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             | Semester    |   | <b>VI</b>   |                 |             |              |              |              |                       |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit      | Maximum Marks   |             |                 |             |              |              |              |                       |              |              |              |
|  |  | L                | T           | P           |             | C   | CA          | ES<br>E         | Total       |              |              |              |                       |              |              |              |
| <b>U19EE624</b>  | <b>Power Electronics Laboratory</b>  | 0                | 0           | 4           | 2           | 60  | 40          | 100             |             |              |              |              |                       |              |              |              |
| <b>Course Objective</b>  | The students should be able to <ul style="list-style-type: none"> <li>Analyze the static characteristics of Power Semiconductor Devices.</li> <li>Analyze and design the current and speed controllers for a closed loop solid DC motor drive and induction motor drive.</li> <li>Perform various testing in AC motor drive and control parameters of DC motor and three phase Induction motor.</li> </ul> |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |             |             |             |   |             | Knowledge Level |             |              |              |              |                       |              |              |              |
|  | <b>CO1:</b> Analyze the V-I characteristics of SCR, MOSFET, IGBT and TRIAC.  |                  |             |             |             |   |             | K4              |             |              |              |              |                       |              |              |              |
|  | <b>CO2:</b> Analyze the working of drives in generating and motoring modes.  |                  |             |             |             |   |             | K4              |             |              |              |              |                       |              |              |              |
|  | <b>CO3:</b> Understand the multi quadrant operation of drives.   |                  |             |             |             |   |             | K3              |             |              |              |              |                       |              |              |              |
|  | <b>CO4:</b> Analyze the operation of Single Phase AC voltage controller.   |                  |             |             |             |   |             | K4              |             |              |              |              |                       |              |              |              |
| <b>CO5:</b> Interpret the need of protection circuits for thyristors, develop a power converter    |  |                  |             |             |             |   | K6          |                 |             |              |              |              |                       |              |              |              |
| <b>Pre-requisites</b>  | -  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |  |                  |             |             |             |   |             |                 |             |              |              |              | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |             |             |             |   |             |                 |             |              |              |              | PSOs                  |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>     | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 3                | 3           |             | 1           |   |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 2</b>  | 3  | 2                | 3           |             | 1           |   |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 3</b>  | 2  | 3                | 3           |             | 1           |   |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 4</b>  | 2  | 2                | 3           |             | 1           |   |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 5</b>  | 3  | 3                | 3           |             | 1           |   |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>Course Assessment Methods</b>   |  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
| <b>Direct</b>  |  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
| 1.Pre lab and Post lab test<br>2. Record mark<br>3. End-Semester examinations                      |  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |
| 1.Course - end survey  |  |                  |             |             |             |   |             |                 |             |              |              |              |                       |              |              |              |



**Content of the syllabus**



| <b>S.No</b>         | <b>LIST OF EXPERIMENTS</b>  | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
|---------------------|---|-----------------------|---|
| 1.                  | Static characteristics of SCR, MOSFET.  | CO1                   | PO1,PSO1  |
| 2.                  | Static Characteristics of IGBT and TRIAC.   | CO1                   | PO1,PSO1  |
| 3.                  | AC to DC half controlled converter  | CO2                   | PO1,PO3,PSO1  |
| 4.                  | AC to DC fully controlled Converter   | CO2                   | PO1,PO3,PSO1  |
| 5.                  | IGBT based single phase PWM inverter  | CO3                   | PO2,PO3,PSO1  |
| 6.                  | IGBT based three phase PWM inverter   | CO3                   | PO2,PO3,PSO1  |
| 7.                  | Experimental Verification of Boost regulator  | CO3                   | PO2,PO3,PSO1  |
| 8.                  | Experimental Verification of Buck regulator.  | CO3                   | PO2,PO3,PSO1  |
| 9.                  | Experimental Verification of cycloconverter.  | CO4                   | PO2,PO3,PSO1  |
| 10.                 | Experimental Verification of AC-AC voltage regulator.   | CO4                   | PO3,PSO1  |
| 11.                 | Simulation of PE circuits (1 $\Phi$ & 3 $\Phi$ semiconverter, 1 $\Phi$ & 3 $\Phi$ full converter, dc-dc converters) | CO5                   | PO1,PO2,PO3,PO5<br>PSO1                               |
| <b>Total period</b> |   |                       | <b>45</b>   |

Signature of the BOS Chairman, EEE

|  |   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
|--|---|------------------|-------------|-------------|---|---------------|-------------|-----------------|-------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |             |             |  |               |             |                 |             |              |              |              |                       |              |              |              |
| Programme  | <b>B.E.</b>   | Programme Code   |             |             | <b>102</b>  | Regulation    | <b>2019</b> |                 |             |              |              |              |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             |             | Semester  |               | <b>VI</b>   |                 |             |              |              |              |                       |              |              |              |
| Course Code  | Course Name   | Periods Per Week |             |             | Credit  | Maximum Marks |             |                 |             |              |              |              |                       |              |              |              |
|  |   | L                | T           | P           |   | C             | CA          | ESE             | Total       |              |              |              |                       |              |              |              |
| <b>U19EE625</b>  | <b>Power System Simulation Laboratory</b>   | 0                | 0           | 4           | 2   | 60            | 40          | 100             |             |              |              |              |                       |              |              |              |
| <b>Course Objective</b>  | The students should be able to <ul style="list-style-type: none"> <li>• Solve the algebraic and differential equations by various methods</li> <li>• Form the Y bus by using various method</li> <li>• Analyze the load flow study for AC/DC</li> </ul> |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |             |             |   |               |             | Knowledge Level |             |              |              |              |                       |              |              |              |
|  | <b>CO1:</b> Compute the line parameters and evaluate the performance indices.   |                  |             |             |   |               |             | K4              |             |              |              |              |                       |              |              |              |
|  | <b>CO2:</b> Analyze the network matrices to carryout various power system studies   |                  |             |             |   |               |             | K4              |             |              |              |              |                       |              |              |              |
|  | <b>CO3:</b> Compute the time current characteristics of analog/digital/numerical relays   |                  |             |             |   |               |             | K3              |             |              |              |              |                       |              |              |              |
| <b>Pre-requisites</b>  | -   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |   |                  |             |             |   |               |             |                 |             |              |              |              | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | <b>Programme Outcomes (POs)</b>   |                  |             |             |   |               |             |                 |             |              |              |              | <b>PSOs</b>           |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b>   | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>     | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 3                | 3           |             | 1   |               |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 2</b>  | 3   | 2                | 3           |             | 1   |               |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 3</b>  | 2   | 3                | 3           |             | 1   |               |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 4</b>  | 2   | 2                | 3           |             | 1   |               |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>CO 5</b>  | 3   | 3                | 3           |             | 1   |               |             | 1               |             |              | 2            | 1            | 2                     | 1            | 1            | 1            |
| <b>Course Assessment Methods</b>   |   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>Direct</b>  |   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
| 1. Pre lab and post lab test<br>2. Record mark<br>3. End-Semester examinations                     |   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>Indirect</b>  |   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |
| 1. Course - end survey   |   |                  |             |             |   |               |             |                 |             |              |              |              |                       |              |              |              |

| <b>Content of the syllabus</b> |   |                       |   |
|--------------------------------|---|-----------------------|---|
| <b>S.No</b>                    | <b>LIST OF EXPERIMENTS</b>  | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
| 1.                             | Computation of line parameters for single and double circuits.                    | CO1                   | PO2,PO3,PO5, PSO2,PSO3                                |
| 2.                             | Modeling of medium transmission lines   | CO1                   | PO2,PO3,PO5, PSO2,PSO3                                |
| 3.                             | Formation of bus admittance matrices  | CO2                   | PO2,PO3,PO5, PSO2,PSO3                                |
| 4.                             | Formation of impedance matrices   | CO2                   | PO2,PO3,PO5, PSO2,PSO3                                |
| 5.                             | Load flow analysis using Gauss Serial method                                      | CO2                   | PO2,PO3,PO5, PSO2,PSO3                                |
| 6.                             | Symmetrical and Unsymmetrical fault analysis                                      | CO3                   | PO2,PO4,PO5, PSO2,PSO3                                |
| 7.                             | Transient and small signal stability analysis: Single-Machine infinite bus system | CO2                   | PO2,PO3,PO5, PSO2,PSO3                                |
| 8.                             | Economic Dispatch in Power Systems  | CO2                   | PO2,PO3,PO5, PSO1,PSO2,PSO3                           |
| 9.                             | Load – Frequency Dynamics of Single- Area and Two-Area Power Systems.             | CO2                   | PO2,PO3,PO5, PSO1,PSO2,PSO3                           |
| 10.                            | Load forecasting and Unit Commitment  | CO2                   | PO2,PO3,PO5, PSO1,PSO2,PSO3                           |
| <b>Total periods</b>           |   | <b>45</b>             |   |

|   |   |                  |   |            |   |               |             |     |
|---|---|------------------|---|------------|---|---------------|-------------|-----|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |                  |   |            |  |               |             |     |
| Programme   | <b>B.E.</b>   | Programme Code   |   | <b>102</b> | Regulation  |               | <b>2019</b> |     |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |   |            | Semester  |               | <b>V</b>    |     |
| Course Code   | Course Name   | Periods Per Week |   |            | Credit  | Maximum Marks |             |     |
|   |   | L                | T | P          |   | C             | CA          | ESE |
| <b>U19MCTY5</b>   | <b>Logical Reasoning</b>  | 2                | 0 | 0          | -   | 100           | -           | 100 |
| <b>Content of the syllabus</b>  |   |                  |   |            |   |               |             |     |
| <b>Unit – I</b>   | <b>VERBAL REASONING</b>   |                  |   |            |   | Periods       | <b>6</b>    |     |
| <b>Coding – Decoding</b> (Letter Coding, Direct Letter Coding, Number/Symbol Coding, Deciphering Message – Word coding and Numeral coding, Substitution Coding, Crypt coding – crypt addition, subtraction, Information Arrangement Coding) , <b>Analogy</b> ( Direct and Simple Analogy, Completing the Analogues pair, Choosing the Analogues pair, Choosing the similar word, Number Analogy, Alphabet Analogy), <b>Classification</b> (Choosing the odd words, Choosing the odd pair of words, Choosing the odd letter group, Choosing the odd number and odd pair of numbers), <b>Alphabet Test</b> (Arrangement according to dictionary, Alpha-Numeric sequence, Letter word problems, Rule detection ) , Word Formation (Using letters from a given word, By unscrambling words)   |   |                  |   |            |   |               |             |     |
| <b>Unit - II</b>  | <b>SITTING ARRANGEMENT &amp; SENSE TEST</b>   |                  |   |            |   | Periods       | <b>6</b>    |     |
| <b>Sitting Arrangement</b> (Arrangement in a line, Arrangement around of a circle, square and rectangle, Arrangement around pentagonal and hexagonal, <b>Direction Sense Test</b> [(Main, Cardinal and Shortest Direction)Final Detection, Displacement, Direction and Displacement], <b>Number, Ranking, Time sequence Test</b> (Number Test, Ranking Test, Time Sequence Test), Puzzles (Based on classification, Based on placing and comparison, Family Based problems)   |   |                  |   |            |   |               |             |     |
| <b>Unit – III</b>   | <b>NUMBER AND LETTER SERIES</b>   |                  |   |            |   | Periods       | <b>6</b>    |     |
| <b>Number and Letter Series</b> [( <b>Number Series</b> : To find a missing term, Find the number that does not follow the pattern, Miscellaneous pattern of the series ( Based on addition / subtraction of consecutive odd / even no"s, Based on addition / subtraction of prime numbers, Multiplication and Division, Based on addition / subtraction of squares of natural numbers, Based on addition / subtraction of cubes of natural numbers) , <b>Letter Series</b> (Alphabet Series, Continuous pattern of series)], <b>Inserting the missing character, Age, Blood</b> (Jumbled up descriptions, Relation puzzles, Coded Relations), <b>Clock and calendar</b> (Mathematical operations and Notations- Problem of solving by substitution, Interchanging signs and numbers, Deriving the appropriate conclusions), <b>Logical order of words, Clerical aptitude</b> (Question based on address, Question based on issues) |   |                  |   |            |   |               |             |     |
| <b>Unit – IV</b>  | <b>LOGICAL AND ANALYTICAL REASONING</b>   |                  |   |            |   | Periods       | <b>6</b>    |     |
| <b>Logical venn diagrams</b> (Universal positive, Universal Negative, Universal Affirmative or Negative, Miscellaneous, Geometrical Figures on Venn Diagrams), <b>Eligibility test, Syllogisms, Statement and Assumptions, Statement and Conclusions, Statement and Arguments, Statement and Course of Action, Verification of Truth of the Statement, Data Sufficiency.</b>  |   |                  |   |            |   |               |             |     |
| <b>Unit – V</b>   | <b>DATA INTERPRETATION &amp; FLOW CHART</b>   |                  |   |            |   | Periods       | <b>6</b>    |     |
| <b>Input – Output</b> (Shifting, Arranging), <b>Data Interpretation</b> (Table chart, Bar chart, Pie chart, Miscellaneous chart,Mixedchart), <b>Cube</b> (noofsidedpainted,Fullcube,cuttingcube), <b>Flowchart</b> (Descriptionflowchart, Value updating flow chart), <b>Quantitative reasoning, Logical deduction, Deductive reasoning, Binarylogic</b>  |   |                  |   |            |   |               |             |     |
| <b>Total Periods</b>  |   |                  |   |            |   |               | <b>30</b>   |     |
| <b>Text Books</b>   |   |                  |   |            |   |               |             |     |
| <b>1.</b>   | How to crack Test of Reasoning - Jai kishan and Prem kishan -arihant publication  |                  |   |            |   |               |             |     |
| <b>References</b>   |   |                  |   |            |   |               |             |     |
| <b>1.</b>   | How to prepare logical reasoning for CAT – Arun Sharma – Mc Graw Hill Publication   |                  |   |            |   |               |             |     |

|   |   |                  |            |            |   |               |           |       |
|---|---|------------------|------------|------------|---|---------------|-----------|-------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University ,Chennai)<br>Elayampalayam, Tiruchengode – 637 205 |                  |            |            |  |               |           |       |
| Programme   | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b>   |               |           |       |
| Department  | <b>ELETRICAL AND ELCTRONIS ENGINEERING</b>  |                  |            | Semester   | <b>VI</b>   |               |           |       |
| Course Code   | Course Name   | Periods Per Week |            |            | Credit  | Maximum Marks |           |       |
|   |   | L                | T          | P          | C   | CA            | ESE       | Total |
| <b>U19MCTY6</b>   | <b>PERSONALITY DEVELOPMENT</b>  | 3                | 0          | 0          | -   | 100           | -         | 100   |
| <b>Content of the syllabus</b>  |   |                  |            |            |   |               |           |       |
| <b>Unit – I</b>   | <b>NUMERICAL ABILITY</b>  |                  |            |            |   | Periods       | <b>8</b>  |       |
| Number Properties – Time & Work – Pipes & Cisterns - Time, Speed & Distance – Ratios & Proportions – Mixtures & Alligations – Averages – Percentages – Profit & Loss – Simple & Compound Interest – Problems on Ages – Partnership – Mensuration – Geometry - Miscellaneous |   |                  |            |            |   |               |           |       |
| <b>Unit - II</b>  | <b>LOGICAL REASONING</b>  |                  |            |            |   | Periods       | <b>8</b>  |       |
| Coding Decoding – Blood Relations – Direction Sense Test – Seating Arrangement – Number Series – Syllogisms – Venn Diagrams – Statements – Data Interpretation – Data Sufficiency – Clocks & Calendars - Miscellaneous  |   |                  |            |            |   |               |           |       |
| <b>Unit – III</b>   | <b>SOFT SKILLS &amp; VERBAL ABILITY</b>   |                  |            |            |   | Periods       | <b>8</b>  |       |
| Resume Preparation – Mock GD – Interview Etiquette – Mock Interview – Reading Comprehension – Essay Writing   |   |                  |            |            |   |               |           |       |
| <b>Unit - IV</b>  | <b>TECHNICAL SKILLS I</b>   |                  |            |            |   | Periods       | <b>8</b>  |       |
| Recap of C – Variables & Datatypes – Console IO Operations – Operators & Expressions – Control Flow Statements – Working with Functions – Working with Arrays   |   |                  |            |            |   |               |           |       |
| <b>Unit – V</b>   | <b>TECHNICAL SKILLS II</b>  |                  |            |            |   | Periods       | <b>8</b>  |       |
| Pointers – String Handling – Structures & Unions – File Handling – Pre Processor Directives – Command Line Arguments & Variables – Searching & Sorting – Stack – Queue – Linked List - Trees  |   |                  |            |            |   |               |           |       |
| <b>Total Periods</b>  |   |                  |            |            |   |               | <b>40</b> |       |
| <b>REFERENCES</b>   |   |                  |            |            |   |               |           |       |
| 1.Quantum Cat by Sarvesh Verma –Arihant Publications  |   |                  |            |            |   |               |           |       |
| 2.Qualitative aptitude by R.S. Aggarwal   |   |                  |            |            |   |               |           |       |
| 3.A Modern Approach to Verbal & Non-Verbal Reasoning by R.S.Aggarwal  |   |                  |            |            |   |               |           |       |
| 4.Word Power Made Easy by Norman Lewis  |   |                  |            |            |   |               |           |       |
| 5.Let us C By Yashavant P Kanetkar  |   |                  |            |            |   |               |           |       |
| 6.Programming in ANSI C By E. Balaguruswamy   |   |                  |            |            |   |               |           |       |



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|   |  |                  |            |            |             |               |     |                        |
|---|--|------------------|------------|------------|-------------|---------------|-----|------------------------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |     |                        |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   | <b>VII</b>  |               |     |                        |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |     |                        |
|   |  | L                | T          | P          | C           | CA            | ESE | Total                  |
| <b>U19HS704</b>   | <b>Total Quality Management</b>  | 3                | 0          | 0          | 3           | 40            | 60  | 100                    |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>Understand the process of managing quality and managing services.</li> <li>Understand the fundamental disciplines of business are intrinsically linked with the concepts of service excellence and quality.</li> <li>Understand the challenges in Quality Improvement Programs</li> </ul> |                  |            |            |             |               |     |                        |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               |     | <b>Knowledge Level</b> |
|   | <b>CO1:Realize the importance of significance of quality</b>   |                  |            |            |             |               |     | K1                     |
|   | <b>CO2:Know the principles of quality and continuous process improvement</b>   |                  |            |            |             |               |     | K2                     |
|   | <b>CO3:Understand the concepts of process control</b>  |                  |            |            |             |               |     | K2                     |
|   | <b>CO4:Choose appropriate statistical techniques for improving processes</b>   |                  |            |            |             |               |     | K1                     |
| <b>CO5:Apply various Quality Systems and Auditing on implementation of Total Quality Management</b> |  |                  |            |            |             |               | K2  |                        |
| <b>Pre-requisites</b>   | U19HS603 -Principles of Management   |                  |            |            |             |               |     |                        |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |      |      |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|------|------|
| Cos   | Programme Outcomes (Pos) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |      |      |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1                  | PSO 2 | PSO3 | PSO4 |
| CO 1  | -                        | 3    | 2    | -    | 2    | -    | -    | 2    | 3    | 2     | -     | 2     | -                     | -     | -    | 2    |
| CO 2  | -                        | 3    | 2    | -    | 2    | -    | -    | 2    | 3    | 2     | -     | 2     | -                     | -     | -    | 2    |
| CO 3  | -                        | 3    | 2    | -    | 2    | -    | -    | 2    | 3    | 2     | -     | 2     | -                     | -     | -    | 2    |
| CO 4  | -                        | 3    | 2    | -    | 2    | -    | -    | 2    | 3    | 2     | -     | 2     | -                     | -     | -    | 2    |
| CO 5  | -                        | 3    | 2    | -    | 2    | -    | -    | 2    | 3    | 2     | -     | 2     | -                     | -     | -    | 2    |

**Course Assessment Methods**

**Direct**



1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

**Indirect**



1. Course – end Survey

| <b>Content of the syllabus</b>   |  |                |           |
|--|--|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction –Definition- Need for quality – Evolution of quality – Quality Dimensions- Products and Services- Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM   |  |                |           |
| <b>Unit – II</b>   | <b>TQM PRINCIPLES</b>  | <b>Periods</b> | <b>9</b>  |
| Leadership – Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating. |  |                |           |
| <b>Unit – III</b>  | <b>STATISTICAL PROCESS CONTROL</b>   | <b>Periods</b> | <b>9</b>  |
| Significance of statistical process control (SPC)- Process capability – Definition, significance and measurement- Total productive maintenance (TMP)- Business process Improvement (BPI)   |  |                |           |
| <b>Unit - IV</b>   | <b>TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT</b>   | <b>Periods</b> | <b>9</b>  |
| Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation.   |  |                |           |
| <b>Unit – V</b>  | <b>QUALITY SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| ISO 9000:2000,ISO 9001: 2015, ISO 9004:2018, ISO 9011:2018 Quality System – Elements, Documentation, Quality auditing- Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.   |  |                |           |
| <b>Total Periods</b>   |  |                | <b>45</b> |
| <b>Text Books</b>  |  |                |           |
| 1.   | Dale H.Besterfield, Carol Besterfield – Michna, Glen H. Besterfield, Mary Besterfield – Sacre, Hermant – Urdhwareshe, RashmiUrdhwareshe, “Total Quality Management” Revised.0F0.Ifth.0 edition, Pearson Education, 2018  |                |           |
| 2.   | James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.   |                |           |
| <b>References</b>  |  |                |           |
| 1.   | Jay Heizer, Barry Render , Chuck Munson, Operations Management, Twelfth Edition, Pearson Education, 2017   |                |           |
| 2.   | Stephen Robbins, Mary Coulter, “Fundamentals of Management” Nineth Edition, Pearson Education, 2016  |                |           |
| 3.   | V. Vijayan and H. Ramakrishnan, “Total Quality Management”,S. Chand Publishing ,2014.  |                |           |
| 4  | <u><a href="#">K. ShridharaBhat , Total Quality Management: Text and Cases, Himalaya Publishing House, 2010.</a></u>   |                |           |
| <b>E-Resources</b>   |  |                |           |
| 1.   | <u><a href="https://www.srividyaengg.ac.in/coursematerial/Mech/114741.pdf">https://www.srividyaengg.ac.in/coursematerial/Mech/114741.pdf</a></u>   |                |           |
| 2.   | <u><a href="http://www.uop.edu.pk/ocontents/Total%20Quality%20Management%20by%20Dale%20H.%20Besterfield,%20Carol%20BesterfieldMichna.%20Glen%20H.%20Besterfield.%20Mary%20Besterfield-Sacre,%20Hemant%20Urdhwareshe,%20Rashmi%20Urdhwarshe%20(z-lib.org).pdf">http://www.uop.edu.pk/ocontents/Total%20Quality%20Management%20by%20Dale%20H.%20Besterfield,%20Carol%20BesterfieldMichna.%20Glen%20H.%20Besterfield.%20Mary%20Besterfield-Sacre,%20Hemant%20Urdhwareshe,%20Rashmi%20Urdhwarshe%20(z-lib.org).pdf</a></u> |                |           |
| 3.   | <u><a href="https://www.kngac.ac.in/elearning-portal/ec/admin/contents/518KP3COELCO4_2020101610563491.pdf">https://www.kngac.ac.in/elearning-portal/ec/admin/contents/518KP3COELCO4_2020101610563491.pdf</a></u>   |                |           |
| 4.   | David Hoyle, ISO 9000 Quality Systems Handbook-updated for the ISO 9001: 2015 standard: Increasing the Quality of an Organization’s Outputs, Routledge publisher, 2017   |                |           |



|   |   |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
|---|---|------------------|------|------|------------|---|-------------|------------------------|-------|-------|-------|-----------------------|-------|-------|-------|-------|
|                  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |      |      |            |  |             |                        |       |       |       |                       |       |       |       |       |
| Programme   | <b>B.E.</b>   | Programme Code   |      |      | <b>102</b> | Regulation  | <b>2019</b> |                        |       |       |       |                       |       |       |       |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |      |      | Semester   |   |             | <b>VII</b>             |       |       |       |                       |       |       |       |       |
| Course Code   | Course Name   | Periods Per Week |      |      | Credit     | Maximum Marks   |             |                        |       |       |       |                       |       |       |       |       |
|   |   | L                | T    | P    |            | C   | CA          | ESE                    | Total |       |       |                       |       |       |       |       |
| <b>U19EE726</b>   | <b>Digital Signal Processing</b>  | 3                | 0    | 0    | 3          | 40  | 60          | 100                    |       |       |       |                       |       |       |       |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Understand the Signals and systems &amp; their mathematical representation.</li> <li>• Understand the Discrete time systems.</li> <li>• Understand the Transformation techniques &amp; their computation.</li> <li>• Understand the Filters and their design for digital implementation.</li> <li>• Understand the Programmability digital signal processor &amp; quantization effects.</li> </ul> |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |      |      |            |   |             | <b>Knowledge Level</b> |       |       |       |                       |       |       |       |       |
|   | <b>CO1:</b> Analyze the discrete time systems.  |                  |      |      |            |   |             | K1                     |       |       |       |                       |       |       |       |       |
|   | <b>C O2:</b> Acquire knowledge on Signals and systems & their mathematical representation.  |                  |      |      |            |   |             | K2                     |       |       |       |                       |       |       |       |       |
|   | <b>CO3:</b> Understand the importance of Fourier transform and its effective computation.   |                  |      |      |            |   |             | K4                     |       |       |       |                       |       |       |       |       |
|   | <b>CO4:</b> Understand the types of filters and their design for digital implementation.  |                  |      |      |            |   |             | K1                     |       |       |       |                       |       |       |       |       |
| <b>CO5:</b> Acquire knowledge on programmability digital signal processor & quantization effects. |   |                  |      |      |            |   | K2          |                        |       |       |       |                       |       |       |       |       |
| <b>Pre-requisites</b>   | 1.U19MA303 -Transforms and Partial Differential Equations<br>2.U19EE517 -Microprocessors and Microcontroller  |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak |   |                  |      |      |            |   |             |                        |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |       |
| <b>Cos</b>  | Programme Outcomes (Pos)  |                  |      |      |            |   |             |                        |       |       |       |                       | PSOs  |       |       |       |
|   | PO 1  | PO 2             | PO 3 | PO 4 | PO 5       | PO 6  | PO 7        | PO 8                   | PO 9  | PO 10 | PO 11 | PO 12                 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 2   | 2                | -    | -    | -          | -   | -           | -                      | -     | -     | -     | -                     | 3     | -     | 3     | -     |
| CO 2  | 2   | 2                | -    | -    | -          | -   | -           | -                      | -     | -     | -     | -                     | 3     | -     | 3     | 2     |
| CO 3  | 2   | 3                | 2    | 2    | -          | -   | -           | -                      | -     | -     | 2     | -                     | 2     | 2     | 3     | 2     |
| CO 4  | 2   | 2                | 2    | 2    | -          | -   | -           | -                      | -     | -     | 2     | -                     | 2     | -     | 3     | 3     |
| CO 5  | 2   | -                | 3    | 2    | 2          | -   | -           | -                      | -     | -     | 2     | 2                     | 2     | 3     | 2     | 3     |
| <b>Course Assessment Methods</b>  |   |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
| <b>Direct</b>   |   |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
| 1. 1.Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations      |   |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
| <b>Indirect</b>   |   |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |
| 1.Course – end Survey   |   |                  |      |      |            |   |             |                        |       |       |       |                       |       |       |       |       |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION</b>   | <b>Periods</b> | <b>9</b>  |
| Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. |   |                |           |
| <b>Unit – II</b>   | <b>DISCRETE TIME SYSTEM ANALYSIS</b>  | <b>Periods</b> | <b>9</b>  |
| Z-transform and its properties, inverse Z-transforms; difference equation – Solution by Z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.  |   |                |           |
| <b>Unit – III</b>  | <b>DISCRETE FOURIER TRANSFORM &amp; COMPUTATION</b>   | <b>Periods</b> | <b>9</b>  |
| Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.  |   |                |           |
| <b>Unit - IV</b>   | <b>DESIGN OF DIGITAL FILTERS</b>  | <b>Periods</b> | <b>9</b>  |
| FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters.   |   |                |           |
| <b>Unit – V</b>  | <b>DIGITAL SIGNAL PROCESSORS</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction – TMS320C Fixed point and floating point Architecture – Features – Addressing Formats – Functional modes –Applications in video coding.   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | S.K. Mitra, ‘Digital Signal Processing – A Computer Based Approach’, McGraw Hill Edu, 2013.   |                |           |
| 2.   | Lonnie C.Ludeman ,”Fundamentals of Digital Signal Processing”,Wiley,2013  |                |           |
| 3.   | J.G. Proakis and D.G. Manolakis, ‘Digital Signal Processing Principles, Algorithms and Applications’, Pearson Education, New Delhi, PHI. 2003.  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab”, Cengage Learning,2014.   |                |           |
| 2.   | SenM.kuo, woonseng...s.gan, “Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013  |                |           |
| 3.   | DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing, Cambridge, 2012.  |                |           |
| 4.   | B.P.Lathi, ‘Principles of Signal Processing and Linear Systems’, Oxford University Press, 2010.   |                |           |
| 5.   | Taan S. ElAli, ‘Discrete Systems and Digital Signal Processing with Mat Lab’, CRC Press, 2009   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://www.tutorialsduniya.com/notes/digital-signal-processing-notes/">https://www.tutorialsduniya.com/notes/digital-signal-processing-notes/</a>   |                |           |
| 2.   | <a href="https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/study-materials/">https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/study-materials/</a> |                |           |
| 3.   | <a href="https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DIGITAL%20SIGNAL%20PROCESSING.pdf">https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DIGITAL%20SIGNAL%20PROCESSING.pdf</a>         |                |           |

|   |   |                  |            |            |   |               |    |                        |
|---|---|------------------|------------|------------|---|---------------|----|------------------------|
|  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |            |            |  |               |    |                        |
| Programme   | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b>   |               |    |                        |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>VII</b>  |               |    |                        |
| Course Code   | Course Name   | Periods Per Week |            |            | Credit  | Maximum Marks |    |                        |
|   |   | L                | T          | P          |   | C             | CA | ESE                    |
| <b>U19EE727</b>   | <b>Embedded System</b>  | 3                | 0          | 0          | 3   | 40            | 60 | 100                    |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>Understand the techniques of inter facing between processors &amp; peripheral device related to embedded processing.</li> <li>Analyze the Various process scheduling algorithms.</li> <li>Acquire an exposure to embedded software development process and tools.</li> <li>Understand the real time operating system and example tutorials to discuss on one real time operating system tool.</li> </ul> |                  |            |            |   |               |    |                        |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |            |            |   |               |    | <b>Knowledge Level</b> |
|   | <b>CO1:</b> Suggest an embedded system for a given application.   |                  |            |            |   |               |    | K1                     |
|   | <b>CO2:</b> Operate various Embedded Development Strategies.  |                  |            |            |   |               |    | K2                     |
|   | <b>CO3:</b> Study about the bus Communication in processors.  |                  |            |            |   |               |    | K4                     |
|   | <b>CO4:</b> Acquire knowledge on various processor scheduling algorithms.   |                  |            |            |   |               |    | K1                     |
| <b>CO5:</b> Understand basics of Real time operating system.                      |   |                  |            |            |   |               | K2 |                        |
| <b>Pre-requisites</b>   | U19EE517 -Microprocessors and Microcontrollers  |                  |            |            |   |               |    |                        |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| Cos   | Programme Outcomes (Pos) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3                        | 3    | -    | -    | -    | -    | -    | -    | -    | -     | -     | -     | 3                     | -     | 2     | 2     |
| CO 2  | 2                        | 2    | -    | 2    | -    | -    | -    | -    | -    | -     | -     | -     | 3                     | -     | 2     | 2     |
| CO 3  | 2                        | 2    | 2    | 2    | -    | -    | -    | -    | -    | -     | -     | -     | 2                     | 2     | 2     | 3     |
| CO 4  | 2                        | 2    | 2    | 2    | 3    | -    | -    | -    | -    | -     | -     | 2     | 3                     | 2     | 2     | 2     |
| CO 5  | 3                        | 3    | 3    | 3    | 3    | -    | -    | -    | -    | 2     | 2     | 2     | 2                     | 3     | 3     | 3     |

### Course Assessment Methods



#### Direct

- Continuous Assessment Test I, II & III
- Assignment
- End-Semester examinations

#### Indirect

- Course – end Survey

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION TO EMBEDDED SYSTEM</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction to Embedded systems – Structural units in Embedded processor, selection of processor – Processor Embedded into a system – Embedded hardware units – Power source, Register, memory devices, ports, timer, interrupt controllers – Embedded Software in a System.  |   |                |           |
| <b>Unit – II</b>   | <b>DEVICES &amp; BUSES FOR DEVICES NETWORK</b>  | <b>Periods</b> | <b>9</b>  |
| I/O devices; timer & counting devices; serial communication using I2C, CAN, USB buses; parallel communication using ISA, PCI, PCI/X buses, arm bus – Internet Enabled Systems – Wireless and Mobile System protocols.  |   |                |           |
| <b>Unit – III</b>  | <b>PROGRAMMING AND SCHEDULING</b>   | <b>Periods</b> | <b>9</b>  |
| Intel I/O instructions – Synchronization - Transfer rate, latency; interrupt driven input and output - Nonmaskable interrupts, software interrupts, Preventing interrupts overrun - Disability interrupts. Multithreaded programming –Context Switching, Preemptive and non-preemptive multitasking, semaphores. Scheduling-thread states, pending threads, context switching  |   |                |           |
| <b>Unit - IV</b>   | <b>RTOS BASED EMBEDDED SYSTEM DESIGN</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, $\mu$ C/OS-II. |   |                |           |
| <b>Unit – V</b>  | <b>EMBEDDED SYSTEM APPLICATION DEVELOPMENT</b>  | <b>Periods</b> | <b>9</b>  |
| Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine – Digital camera  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Shibu. K.V, “Introduction to Embedded Systems”, Mcgraw Hill, 2017.  |                |           |
| 2.   | Raj Kamal, ‘Embedded System-Architecture, Programming, Design’, McGraw Hill, 2013.  |                |           |
| 3.   | Peckol, “Embedded system Design”, John Wiley & Sons, 2010.  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013  |                |           |
| 2.   | C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.   |                |           |
| 3.   | Jonathan W. Valvano, “Embedded Microcomputer Systems Real time Interfacing”, Cengage learning , 3rd edition ,2012   |                |           |
| 4.   | Han-Way Huang, “Embedded system Design Using C8051”, Cengage Learning, 2009.  |                |           |
| 5.   | Rajib Mall “Real-Time systems Theory and Practice” Pearson Education, 2007.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://mrcet.com/downloads/digital_notes/ECE/IV%20Year/EMBEDDED%20SYSTEMS%20DESIGN.pdf">https://mrcet.com/downloads/digital_notes/ECE/IV%20Year/EMBEDDED%20SYSTEMS%20DESIGN.pdf</a> |                |           |
| 2.   | <a href="https://www.tutorialspoint.com/embedded_systems/es_overview.htm">https://www.tutorialspoint.com/embedded_systems/es_overview.htm</a>   |                |           |
| 3.   | <a href="https://www.slideshare.net/yayavaram/embedded-systems-class-notes">https://www.slideshare.net/yayavaram/embedded-systems-class-notes</a>   |                |           |

|  |  |                  |   |   |            |   |             |                 |       |  |
|--|--|------------------|---|---|------------|---|-------------|-----------------|-------|--|
|  | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |   |   |            |  |             |                 |       |  |
| Programme  | <b>B.E.</b>  | Programme Code   |   |   | <b>102</b> | Regulation  | <b>2019</b> |                 |       |  |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |   |   | Semester   |   | <b>VII</b>  |                 |       |  |
| Course Code  | Course Name  | Periods Per Week |   |   | Credit     | Maximum Marks   |             |                 |       |  |
|  |  | L                | T | P |            | C   | CA          | ESE             | Total |  |
| <b>U19EE728</b>  | <b>Embedded System Laboratory</b>  | 0                | 0 | 4 | 2          | 60  | 40          | 100             |       |  |
| <b>Course Objective</b>  | The students should be able to <ul style="list-style-type: none"> <li>• Learn the arduino programming language</li> <li>• Understand the basic programming constructs and articulate how they are used</li> <li>• Develop programs and hardware designs with a desired runtime execution flow</li> <li>• Create their own project</li> </ul> |                  |   |   |            |   |             |                 |       |  |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |   |   |            |   |             | Knowledge Level |       |  |
|  | <b>CO1:</b> Write programs on Arduino IDE  |                  |   |   |            |   |             | K3              |       |  |
|  | <b>CO2:</b> Sketch flow of execution of Arudino programs using algorithm and flowcharts  |                  |   |   |            |   |             | K4              |       |  |
|  | <b>CO3:</b> Create hardware designs on Proteus   |                  |   |   |            |   |             | K4              |       |  |
| <b>Pre-requisites</b>  | U19EE520 - Microprocessors and Microcontrollers Laboratory   |                  |   |   |            |   |             |                 |       |  |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| Cos   | Programme Outcomes (Pos) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| <b>CO 1</b>   | 3                        | -    | 3    | 3    | 3    | 2    | -    | -    | -    | -     | 3     | 3     | 3                     | 3     | 2     | 3     |
| <b>CO 2</b>   | 3                        | -    | 3    | 3    | 3    | 2    | -    | -    | -    | -     | 3     | 3     | 3                     | 3     | 2     | 3     |
| <b>CO 3</b>   | 3                        | -    | 3    | 3    | 3    | 2    | -    | -    | -    | -     | 3     | 3     | 3                     | 3     | 3     | 3     |
| <b>CO 4</b>   | 3                        | -    | 3    | 3    | 3    | 2    | -    | -    | -    | -     | 3     | 3     | 3                     | 3     | 3     | 3     |

### Course Assessment Methods

#### Direct

1. Pre lab and post lab test
2. Record mark
3. End-Semester examinations

#### Indirect

1. Course - end survey

| <b>Content of the syllabus</b> |  |                       |   |
|--------------------------------|--|-----------------------|---|
| <b>S.No</b>                    | <b>LIST OF EXPERIMENTS</b>   | <b>Course Outcome</b> | <b>Program Outcome &amp; Program Specific Outcome</b> |
| 1.                             | LED interface with Arduino   | CO1                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 2.                             | Series of LEDs interface with Arduino                              | CO1                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 3.                             | Controlling Two Bulbs with a double Relay using Arduino            | CO2                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 4.                             | Reading Analog Voltage in Serial Monitor using Arduino             | CO2                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 5.                             | Servo Motor control using Arduino                                  | CO3                   | PO1,PO3,PO5<br>PO9,PO11,PO12,<br>PSO1, PSO4           |
| 6.                             | DC Motor control using Push-Pull 4 Channel driver using Arduino    | CO4                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 7.                             | Connecting sound device buzzer to Arduino                          | CO4                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 8.                             | Measurement of capacitance using Arduino                           | CO1                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 9.                             | Implementation of interfacing of 16 x 2 LCD with Arduino           | CO4                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| 10.                            | Implementation of interfacing of 7segment LED display with Arduino | CO4                   | PO1,PO3,PO5<br>PO9,PSO1,PSO4                          |
| <b>Total periods</b>           |  | <b>45</b>             |   |

**PROFESSIONAL ELECTIVE COURSES :VERTICALS**



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(Autonomous Institution, Affiliated to Anna University, Chennai)  
Elayampalayam, Tiruchengode – 637 205



|   |  |                  |            |            |             |               |     |                        |
|---|--|------------------|------------|------------|-------------|---------------|-----|------------------------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |     |                        |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |     |                        |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |     |                        |
|   |  | L                | T          | P          | C           | CA            | ESE | Total                  |
| <b>U19EEV11</b>   | <b>HVDC Transmission System</b>  | 3                | 0          | 0          | 3           | 40            | 60  | 100                    |
| Course Objective  | The students should made to <ul style="list-style-type: none"> <li>• High voltage direct current transmission has advantages over ac transmission in special situations</li> <li>• Withtheadventofthyristorvalveconverters,HVDCtransmissionbecameeven more attractive</li> <li>• operation, modeling and control of HVDC link in power system</li> </ul> |                  |            |            |             |               |     |                        |
| Course Outcome  | At the end of the course, the student should be able to,   |                  |            |            |             |               |     | <b>Knowledge Level</b> |
|   | <b>CO1:</b> Explain the significance and necessity of HVDC system  |                  |            |            |             |               |     | K2                     |
|   | <b>CO2:</b> Explain the power converters and harmonic filters used in HVDC System  |                  |            |            |             |               |     | K2                     |
|   | <b>CO3:</b> Explaintherequirementofappropriatecontrol strategies and stability Techniques used for HVDC system   |                  |            |            |             |               |     | K2                     |
|   | <b>CO4:</b> Design suitable controller for HVDC converter to obtain desired Output   |                  |            |            |             |               |     | K6                     |
| <b>CO5:</b> Selectsuitableprotectionschemebyidentifyingthefaultinthe System |  |                  |            |            |             |               | K3  |                        |
| Pre-requisites  | <ul style="list-style-type: none"> <li>• Power Electronics, Transmission and Distribution</li> </ul>   |                  |            |            |             |               |     |                        |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       | CO/PSO Mapping |       |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|----------------|-------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |                | PSOs  |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12          | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 2                        | 3    |      |      |      |      |      |      |      |       |       | 2              | 1     |       |       |       |
| CO 2  | 2                        | 3    |      |      |      |      |      |      |      |       |       | 2              | 1     |       | 2     |       |
| CO 3  | 1                        | 2    |      |      |      |      |      |      |      |       |       | 2              | 1     |       | 2     |       |
| CO 4  | 1                        | 2    | 3    |      |      |      |      |      |      |       |       | 2              | 1     |       |       |       |
| CO 5  | 1                        | 2    | 3    |      |      |      |      |      |      |       |       | 2              | 2     | 1     | 2     | 2     |

**Course Assessment Methods**

|   |
|---|
| <b>Direct</b>   |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp;III</li> <li>2. Assignment</li> <li>3. End-Semester examinations</li> </ol> |
| <b>Indirect</b>   |
| <ol style="list-style-type: none"> <li>1. Course – end Survey</li> </ol>  |



| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>Introduction</b>   | <b>Periods</b> | <b>9</b>  |
| Development of HVDC technology-Significance of DC transmission-Overview and organization of HVDC systems-Review of the HVDC system reliability-HVDC characteristics and economic aspects     |   |                |           |
| <b>Unit - II</b>   | <b>Power Conversion and Harmonics</b>   | <b>Periods</b> | <b>9</b>  |
| Power conversion - Thyristor, Phase converter, Phase full bridge converter, Pulse converter- Harmonics of HVDC and removal-Determination of resulting harmonic impedance-Active power filter |   |                |           |
| <b>Unit – III</b>  | <b>Control of HVDC Converter and System</b>   | <b>Periods</b> | <b>9</b>  |
| Converter control for an HVDC system-Commutation failure- HVDC control and design- HVDC control functions- Reactive power and voltage stability- Interactions between AC and DC systems      |   |                |           |
| <b>Unit - IV</b>   | <b>Protection of HVDC System</b>  | <b>Periods</b> | <b>9</b>  |
| Valve protection functions- Protective action of an HVDC system-Protection by control actions-Fault analysis-Insulation coordination of HVDC   |   |                |           |
| <b>Unit – V</b>  | <b>Trends for HVDC Applications</b>   | <b>Periods</b> | <b>9</b>  |
| Wind Farm Technology- Modern Voltage Source Converter (VSC)- 800 kV HVDC System- Practical examples of an HVDC system  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Chan-Ki Kim, “HVDC Transmission Power Conversion Applications in Power Systems”, John Wiley & Sons Pvt. Ltd., 2009  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | P.Kundur, “Power System Stability and Control”, McGraw-Hill, 1993   |                |           |
| 2.   | K.R.Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.  |                |           |
| 3.   | J.Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.   |                |           |
| 4.   | Erich Uhlmann, “Power Transmission by Direct Current”, BSP Publications, 2004.  |                |           |
| 5.   | V.K.Sood, “HVDC and FACTS controllers – Application of Static Converters in Power System”, APRIL 2004, Kluwer Academic Publishers.                            |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://easyengineering.net/hvdc-power-transmission-systems-bu-padiyar/">https://easyengineering.net/hvdc-power-transmission-systems-bu-padiyar/</a> |                |           |
| 2.   | <a href="https://www.smartworld.com/downloads/hvdc-complete-pdf-notes/">https://www.smartworld.com/downloads/hvdc-complete-pdf-notes/</a>                     |                |           |



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|                          |  |                  |            |            |             |               |     |                 |
|--------------------------|--|------------------|------------|------------|-------------|---------------|-----|-----------------|
| Programme                | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |     |                 |
| Department               | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |     |                 |
| Course Code              | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |     |                 |
|                          |  | L                | T          | P          | C           | CA            | ESE | Total           |
| <b>U19EEV12</b>          | <b>Power Quality in Power Systems</b>  | 3                | 0          | 0          | 3           | 40            | 60  | 100             |
| <b>Course Objectives</b> | The students should be made to <ul style="list-style-type: none"> <li>• Understand the standards of power quality problems</li> <li>• Understand power quality monitoring classification techniques</li> <li>• Understand different mitigation techniques</li> </ul> |                  |            |            |             |               |     |                 |
| <b>Course Outcome</b>    | At the end of the course, the student should be able to,   |                  |            |            |             |               |     | Knowledge Level |
|                          | <b>CO1:</b> Understand the major power quality problems.   |                  |            |            |             |               |     | K2              |
|                          | <b>CO2:</b> Apply and analyze/compare techniques available to mitigate power quality problems.   |                  |            |            |             |               |     | K3              |
|                          | <b>CO3:</b> Understand and analyze sources of harmonics and solutions  |                  |            |            |             |               |     | K3              |
|                          | <b>CO4:</b> Understand different types of filters and compensators   |                  |            |            |             |               |     | K2              |
|                          | <b>CO5:</b> Use equipment that are required to measure the quality of power  |                  |            |            |             |               |     | K2              |
| <b>Pre-requisites</b>    | Power Electronics, Power System Analysis   |                  |            |            |             |               |     |                 |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 1                        |      |      | 1    |      |      | 2    |      |      | 1     | 3     | 1     | 1                     |       | 1     | 1     |
| CO 2   | 1                        | 2    | 1    |      |      | 1    |      | 1    | 1    |       |       | 1     |                       | 1     | 1     | 1     |
| CO 3   | 1                        |      | 1    |      | 1    | 2    |      | 1    | 2    |       |       | 1     | 1                     |       |       | 2     |
| CO 4   | 1                        |      | 2    |      |      | 2    |      | 3    | 1    | 3     | 2     | 1     | 1                     |       |       | 2     |
| CO 5   | 1                        |      |      |      | 1    | 2    |      | 2    | 2    |       |       | 1     | 1                     |       |       | 1     |



**Course Assessment Methods**

|   |
|---|
| <b>Direct</b>   |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>1 End-Semester examinations |
| <b>Indirect</b>   |
| 1. Course – end Survey  |

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>INTRODUCTION</b>   | <b>Periods</b> | <b>9</b>  |
| Electric power quality phenomena: IEEE and IEC - EMC standards, overview of power quality disturbances - voltage variations, interruptions, transients, waveform distortion and power frequency variations– Computer Business Equipment Manufacturers Associations (CBEMA) curve.   |   |                |           |
| <b>Unit - II</b>  | <b>VOLTAGE SAG AND SWELL</b>  | <b>Periods</b> | <b>9</b>  |
| Estimating voltage sag performance – Thevenins equivalent source – Analysis and calculation of various faulted condition – Estimation of the sag severity – Mitigation of voltage sag– Mitigation of voltage swell.   |   |                |           |
| <b>Unit – III</b>   | <b>HARMONIC ANALYSIS</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction of Harmonic Analysis - Fourier series and coefficients – Fourier transforms, discrete Fourier Transform -fast Fourier transform -Window function- numerical problems.  |   |                |           |
| <b>Unit - IV</b>  | <b>HARMONIC ELIMINATION</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction of Harmonic elimination- Design and analysis of filters to reduce harmonic distortion – Power conditioners, passive filter, active filter - shunt , series, hybrid filters.  |   |                |           |
| <b>Unit – V</b>   | <b>POWER QUALITY MONITORING AND MANGEMENT</b>   | <b>Periods</b> | <b>9</b>  |
| Power quality Monitoring considerations: Power line disturbance analyzer - power quality measurement equipment - harmonic spectrum analyzer - flicker meters – disturbance analyzer. Power Quality Management in Smart Grid: Introduction of Power Quality in Smart Grid - Power Quality issues of Grid connected Renewable Energy Sources - Power Quality Conditioners for Smart Grid. |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Dugan C. Roger, “Electrical Power Systems Quality”, 3rd Edition, Tata McGraw Hill, New Delhi, 2012.                                   |                |           |
| 2.  | F. Fuchs and Mohammad A.S. Masoum “Power Quality in Power Systems and Electrical Machines Academic Press, 2008                        |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” Wiley, 2015                            |                |           |
| 2.  | Angelo Baggini (Ed.) Handbook of Power Quality, Wiley, 2008   |                |           |
| 3.  | M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press), 2000.                   |                |           |
| 4.  | ArrillagaJ, Watson.N.R and Chen.S, "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2008.                          |                |           |
| 5.  | Sankaran.C, "Power Quality", CRC Press, Washington, D.C., 2002.   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses/108/107/108107157/">https://nptel.ac.in/courses/108/107/108107157/</a>                           |                |           |
| 2.  | <a href="https://lecturenotes.in/subject/53/electrical-power-quality">https://lecturenotes.in/subject/53/electrical-power-quality</a> |                |           |

|  |  |                |                  |             |             |             |               |             |             |              |   |                       |              |              |              |              |
|--|--|----------------|------------------|-------------|-------------|-------------|---------------|-------------|-------------|--------------|---|-----------------------|--------------|--------------|--------------|--------------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                |                  |             |             |             |               |             |             |              |  |                       |              |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code |                  |             |             |             |               |             |             |              |   | <b>102</b>            | Regulation   |              | <b>2019</b>  |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                |                  |             |             |             |               |             |             |              | Semester  |                       |              |              |              |              |
| Course Code  | Course Name  |                | Periods Per Week |             |             | Credit      | Maximum Marks |             |             |              |   |                       |              |              |              |              |
|  |  |                | L                | T           | P           |             | C             | CA          | ESE         | Total        |   |                       |              |              |              |              |
| <b>U19EEV13</b>  | <b>Restructure Power System</b>  |                | 3                | 0           | 0           | 3           | 40            |             | 60          | 100          |   |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to  |                |                  |             |             |             |               |             |             |              |   |                       |              |              |              |              |
|  | <ul style="list-style-type: none"> <li>• Impart knowledge on fundamental concepts of congestion management</li> <li>• Analyze the concepts of locational marginal pricing and financial transmission rights</li> <li>• Understand gain insight on the ancillary service management and pricing of transmission network</li> <li>• Illustrate about the electricity act and various power reforms in India</li> </ul> |                |                  |             |             |             |               |             |             |              |   |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                |                  |             |             |             |               |             |             |              | <b>Knowledge Level</b>  |                       |              |              |              |              |
|  | <b>CO1:</b> Gain knowledge on the fundamentals of deregulation of power systems  |                |                  |             |             |             |               |             |             |              | K2  |                       |              |              |              |              |
|  | <b>CO2:</b> Understand the basics and classification of transmission congestion anagement  |                |                  |             |             |             |               |             |             |              | K2  |                       |              |              |              |              |
|  | <b>CO3:</b> Learn about the fundamental concepts involved in locational margin prices and financial transmission rights  |                |                  |             |             |             |               |             |             |              | K2  |                       |              |              |              |              |
|  | <b>CO4:</b> Understand the significance of ancillary services and pricing of transmission network  |                |                  |             |             |             |               |             |             |              | K2  |                       |              |              |              |              |
| <b>CO5:</b> Gain knowledge about the various reforms in the power sectors of India                 |  |                |                  |             |             |             |               |             |             | K3           |   |                       |              |              |              |              |
| <b>Pre-requisites</b>  | U19EE518 - Power System Analysis   |                |                  |             |             |             |               |             |             |              |   |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                |                  |             |             |             |               |             |             |              |   | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                |                  |             |             |             |               |             |             |              |   |                       | PSOs         |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>    | <b>PO 3</b>      | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b>   | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b>  | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 3              | 2                | 2           | -           | -           | -             | -           | -           | -            | 3   | 2                     | 3            | -            | 2            | 3            |
| <b>CO 2</b>  | 3  | 3              | 2                | 2           | -           | -           | -             | -           | -           | -            | 3   | 2                     | 3            | -            | 2            | 3            |
| <b>CO 3</b>  | 3  | 3              | 2                | 2           | -           | -           | -             | -           | -           | -            | 3   | 2                     | 3            | -            | 2            | 3            |
| <b>CO 4</b>  | 3  | 3              | 2                | 2           | -           | -           | -             | -           | -           | -            | 3   | 2                     | 3            | -            | 2            | 3            |
| <b>CO 5</b>  | 3  | 3              | 2                | 2           | -           | -           | -             | -           | -           | -            | 3   | 3                     | 3            | -            | 2            | 3            |

| <b>Course Assessment Methods</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Direct</b>   |   |                |           |
| 1. Continuous Assessment Test I, II & III   |   |                |           |
| 2. Assignment   |   |                |           |
| 3. End-Semester examinations  |   |                |           |
| <b>Indirect</b>   |   |                |           |
| 1. Course - end Survey  |   |                |           |
| <b>Content of the syllabus</b>  |   |                |           |
| <b>Unit – I</b>   | <b>INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems–Fundamentals of Economics: Consumer 96 behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production– Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity other commodities, Market architecture.   |   |                |           |
| <b>Unit - II</b>  | <b>TRANSMISSION CONGESTION MANAGEMENT</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management–Classification of congestion management methods–Calculation of ATC-Non market methods– Market methods–Nodal pricing– Inter zonal and Intra zonal congestion management–Price area congestion management– Capacity alleviation method   |   |                |           |
| <b>Unit – III</b>   | <b>ELECTRICITY MARKETS</b>  | <b>Periods</b> | <b>9</b>  |
| Competitive gencos and discos in markets, Supply and demand functions, Market equilibrium, types of electricity markets – inter-utility interchanges. Strategic bidding: Market power and its mitigation, Imperfect markets.  |   |                |           |
| <b>Unit - IV</b>  | <b>ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction of ancillary services – Types of Ancillary services Classification of Ancillary services– Load generation balancing related services Voltage control and reactive power support devices– Black start capability service- ancillary service –Co-optimization of energy and reserve services- International comparison Transmission pricing –Principles– Classification– Rolled in transmission pricing methods–Marginal transmission pricing paradigm– Merits and demerits of different paradigm. |   |                |           |
| <b>Unit – V</b>   | <b>REFORMS IN INDIAN POWER SECTOR</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction–Frame work of Indian power sector–Reform initiatives-Availability based tariff Electricity act 2003–Open access issues–Power exchange–Reforms in the near future   |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, “Restructured Electrical power systems: operation, trading and volatility””, CRC Press. 2001   |                |           |
| 2.  | Kankar Bhattacharya, JaapE.Daadler, MathH.J.Boolen,” Operation of Restructured Power Systems”, Kluwer Academic Pub. 2001.   |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Sally Hunt “Making competition work in electricity”, John Willey and Sons Inc.2002  |                |           |
| 2.  | StevenStoft, “Power system economics: designing markets for electricity”, John Wiley&Sons, 2002   |                |           |
| 3.  | M. Shahidehpour, H. Yamin and Zuyi Li, “Market Operations in Electric Power Systems: Forecasting, Scheduling, and Risk Management”, Wiley-IEEE Press, 2002.   |                |           |
| 4.  | Loe Lie Lai “Power Systems Restructuring and Deregulation”, John Wily, 2002   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://link.springer.com/chapter/10.1007/978-1-4615-1465-7_5">https://link.springer.com/chapter/10.1007/978-1-4615-1465-7_5</a>   |                |           |
| 2.  | <a href="https://www.google.com/search?q=Restructure+power+System&amp;rlz=1C1VDKB_enIN958IN958&amp;oq=Restructure+power+System&amp;aqs=chrome..69i57j33i160l3j33i21.32476j0j9&amp;sourceid=chrome&amp;ie=UTF-8">https://www.google.com/search?q=Restructure+power+System&amp;rlz=1C1VDKB_enIN958IN958&amp;oq=Restructure+power+System&amp;aqs=chrome..69i57j33i160l3j33i21.32476j0j9&amp;sourceid=chrome&amp;ie=UTF-8</a> |                |           |
| 3.  | <a href="https://nptel.ac.in/courses/108/101/108101005/#">https://nptel.ac.in/courses/108/101/108101005/#</a>   |                |           |

|  |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
|--|--|------------------|-------------|-------------|---|---------------|-------------|------------------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |  |               |             |                        |             |              |              |                       |              |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code   |             |             | <b>102</b>  | Regulation    | <b>2019</b> |                        |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             | Semester  |               |             |                        |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit  | Maximum Marks |             |                        |             |              |              |                       |              |              |              |              |
|  |  | L                | T           | P           |   | C             | CA          | ESE                    | Total       |              |              |                       |              |              |              |              |
| <b>U19EEV14</b>  | <b>Smart Grid Technologies</b>   | 3                | 0           | 0           | 3   | 40            | 60          | 100                    |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>• Understand the basics of smart grid technology</li> <li>• Familiarize the architecture and components of smart grid</li> <li>• Familiarize the communication and power quality management in Smart Grid.</li> </ul> |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |             |             |   |               |             | <b>Knowledge Level</b> |             |              |              |                       |              |              |              |              |
|  | <b>CO1::</b> Understand on the concepts of Smart Grid and its present developments.  |                  |             |             |   |               |             | K2                     |             |              |              |                       |              |              |              |              |
|  | <b>CO2:</b> Understand the architecture and advanced metering infrastructure.  |                  |             |             |   |               |             | K2                     |             |              |              |                       |              |              |              |              |
|  | <b>CO3:</b> Acquire knowledge about different smart meters and advanced metering infrastructure  |                  |             |             |   |               |             | K2                     |             |              |              |                       |              |              |              |              |
|  | <b>CO4:</b> Understand the communication technologies in smart grid.   |                  |             |             |   |               |             | K2                     |             |              |              |                       |              |              |              |              |
| <b>CO5:</b> Acquire knowledge on power quality management in Smart Grids.  |  |                  |             |             |   |               | K2          |                        |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  | Power system operation and control   |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |  |                  |             |             |   |               |             |                        |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |             |             |   |               |             |                        |             |              |              |                       | PSOs         |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b>   | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 2                | 2           | 2           | 1   | 2             | 3           | 2                      | -           | -            | 2            | 3                     | 3            | -            | 3            | 3            |
| <b>CO 2</b>  | 3  | 3                | 3           | 3           | 1   | 3             | 3           | 2                      | -           | -            | 2            | 3                     | 3            | -            | 3            | 3            |
| <b>CO 3</b>  | 3  | 3                | 3           | 3           | 1   | 3             | 3           | 2                      | -           | -            | 3            | 3                     | 3            | -            | 3            | 3            |
| <b>CO 4</b>  | 3  | 3                | 3           | 3           | 1   | 3             | 3           | 2                      | -           | -            | 3            | 3                     | 3            | -            | 3            | 3            |
| <b>CO 5</b>  | 3  | 3                | 3           | 3           | 1   | 3             | 3           | 2                      | -           | -            | 3            | 3                     | 3            | -            | 3            | 3            |
| <b>Course Assessment Methods</b>   |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp; III</li> <li>2. Assignment</li> <li>3. End-Semester examinations</li> </ol>   |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <ol style="list-style-type: none"> <li>1. Course - end Survey</li> </ol>   |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Content of the syllabus</b>   |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Unit – I</b>  | <b>INTRODUCTION TO SMART GRID</b>  |                  |             |             |   |               |             |                        |             |              |              | <b>Periods</b>        | <b>9</b>     |              |              |              |
| Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid. |  |                  |             |             |   |               |             |                        |             |              |              |                       |              |              |              |              |

|   |   |                |           |
|---|---|----------------|-----------|
| <b>Unit - II</b>  | <b>SMART GRID ARCHITECTURE AND COMPONENTS</b>   | <b>Periods</b> | <b>9</b>  |
| Smart Grid Architecture Models, Components of Smart Grid: Smart Generation systems, Smart Transmission Grid: Geographic Information System (GIS). Intelligent Electronic Devices (IED) & their application for Monitoring & Protection. Wide Area Monitoring Protection and Control (WAMPAC).   |   |                |           |
| <b>Unit – III</b>   | <b>SMART METERS AND ADVANCED METERING INFRASTRUCTURE</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.  |   |                |           |
| <b>Unit - IV</b>  | <b>COMMUNICATION NETWORKS FOR SMART GRID</b>  | <b>Periods</b> | <b>9</b>  |
| Communication Architecture for Smart Grids, Home Area Network (HAN) : IEEE 802.11, IEEE 802.15.4, 6LoWPAN, Neighborhood Area Network (NAN) / Field Area Network (FAN): Radio over Power-Lines (BPL/PLC), IEEE P1901, Wide Area Network (WAN) : Optical Fiber Communication, Cellular Networks, Introduction to Wi-Max and Wireless Sensor Networks. |   |                |           |
| <b>Unit – V</b>   | <b>POWER QUALITY MANAGEMENT IN SMART GRID</b>   | <b>Periods</b> | <b>9</b>  |
| Power Quality in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.   |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Bharat Modi, Anu Prakash & Yogesh Kumar “Fundamentals of Smart Grid Technology” S.K. Kataria & Sons, 2022.  |                |           |
| 2.  | S. Borlase, “Smart Grids, Infrastructure, Technology and Solutions”, CRC Press, 1st Edition, 2013.  |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Stephen F. Bush, “Smart Grid : Communication – Enabled Intelligence for the Electric Power Grid”, Wiley – IEEE Press, 2014.   |                |           |
| 2.  | Ali Keyhani, “Design of Smart Power Grid Renewable Energy Systems”, Wiley, 2016   |                |           |
| 3.  | Janaka.E.Kanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu and Akihiko Yokoyama, “Smart Grid: Technology and Applications”, John Wiley & Sons Ltd., West Sussex, 2012.   |                |           |
| 4.  | James Momoh, “Smart Grid - Fundamentals of Design and Analysis”, IEEE Press, John Wiley & Sons, INC., New Jersey, 2012.   |                |           |
| 5.  | Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid – The New and Improved Power Grid: A Survey” , IEEE Transaction on Smart Grid,2012.  |                |           |
| <b>Resources</b>  |   |                |           |
| 1.  | <a href="https://archive.nptel.ac.in/courses/108/107/108107113/">ps://archive.nptel.ac.in/courses/108/107/108107113/</a>  |                |           |
| 2.  | <a href="https://ganeshphd4u.weebly.com/uploads/7/3/4/0/7340277/ee_e19_smart_grid.pdf">ps://ganeshphd4u.weebly.com/uploads/7/3/4/0/7340277/ee_e19_smart_grid.pdf</a>  |                |           |
| 3.  | <a href="https://www.bharathuniv.ac.in/colleges1/downloads/courseware_eee/Notes/CE3/BEE019%20smart%20grid.pdf">ps://www.bharathuniv.ac.in/colleges1/downloads/courseware_eee/Notes/CE3/BEE019%20smart%20grid.p<br/>df</a> |                |           |



|   |  |                  |   |   |            |               |             |                 |       |
|---|--|------------------|---|---|------------|---------------|-------------|-----------------|-------|
| Programme   | <b>B.E.</b>  | Programme Code   |   |   | <b>102</b> | Regulation    | <b>2019</b> |                 |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |   |   | Semester   |               |             |                 |       |
| Course Code   | Course Name  | Periods Per Week |   |   | Credit     | Maximum Marks |             |                 |       |
|   |  | L                | T | P |            | C             | CA          | ESE             | Total |
| <b>U19EEV15</b>   | <b>Flexible AC Transmission Systems</b>  | 3                | 0 | 0 | 3          | 40            | 60          | 100             |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Understand the state-of-art of the power system.</li> <li>• Understand the FACTS controllers for load flow and dynamic analysis.</li> <li>• Understand the needs and working of shunt compensators and emerging FACTS devices.</li> </ul> |                  |   |   |            |               |             |                 |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |   |   |            |               |             | Knowledge Level |       |
|   | <b>CO1:</b> Explain the necessity and benefits of FACTS controllers.   |                  |   |   |            |               |             | K2              |       |
|   | <b>CO2:</b> Analyze the shunt compensation devices used for power factor improvement.  |                  |   |   |            |               |             | K4              |       |
|   | <b>CO3:</b> Compare series compensation devices based on their operating characteristics.  |                  |   |   |            |               |             | K4              |       |
|   | <b>CO4:</b> Examine the operation of thyristor controlled voltage and phase angle regulators.  |                  |   |   |            |               |             | K2              |       |
| <b>CO5:</b> Analyze the operation of UPFC and IPFC FACTS controllers. |  |                  |   |   |            |               | K3          |                 |       |
| <b>Pre-requisites</b>   | Power Electronics, Transmission & Distribution   |                  |   |   |            |               |             |                 |       |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3                        | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 1    | 2     | 1     | 3     | 3                     | 1     | 2     | 2     |
| CO 2   | 3                        | 3    | 2    | 2    | 2    | 2    | 1    | 1    | 1    | 2     | 2     | 3     | 3                     | 2     | 2     | 2     |
| CO 3   | 3                        | 3    | 2    | 2    | 2    | 1    | 1    | 1    | 1    | 2     | 1     | 3     | 3                     | 2     | 2     | 2     |
| CO 4   | 3                        | 2    | 2    | 2    | 2    | 2    | 1    | 1    | 1    | 2     | 2     | 3     | 3                     | 1     | 1     | 2     |
| CO 5   | 3                        | 2    | 2    | 2    | 2    | 2    | 1    | 1    | 1    | 2     | 2     | 3     | 2                     | 2     | 3     | 2     |

### Course Assessment Methods

#### Direct



1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

#### Indirect

1. Course - end survey



| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION TO FACTS</b>  | <b>Periods</b> | <b>9</b>  |
| Electrical Transmission Network - Opportunities for FACTS - Power Flow in AC System- Dynamic Stability Considerations- Relative importance of controllable parameter -IEEE definitions, FACTS devices in India and abroad.                         |   |                |           |
| <b>Unit - II</b>   | <b>SHUNT COMPENSATORS</b>   | <b>Periods</b> | <b>9</b>  |
| Need for compensation - Concept of shunt compensation- Objectives of shunt compensation- Methods of controllable VAR generation - Thyristor Controlled Reactor (TCR) - Thyristor Switched Capacitor (TSC) - Comparison of TCR & TSC- applications. |   |                |           |
| <b>Unit – III</b>  | <b>SERIES COMPENSATORS</b>  | <b>Periods</b> | <b>9</b>  |
| Principles of operation- types - static series compensation using GCSC, TCSC and TSSC, Static Synchronous Series Compensator (SSSC) – Comparison of TSSC & TCSC Characteristics and control applications.  |   |                |           |
| <b>Unit - IV</b>   | <b>STATIC VOLTAGE PHASE ANGLE REGULATOR</b>   | <b>Periods</b> | <b>9</b>  |
| Objectives of voltage & phase angle regulators - approaches to Thyristor - Controlled Voltage & Phase Angle Regulator- Power system applications.  |   |                |           |
| <b>Unit – V</b>  | <b>EMERGING FACTS CONTROLLER</b>  | <b>Periods</b> | <b>9</b>  |
| STATCOM - Unified Power Flow Controller (UPFC) & Interline Power Flow Controller (IPFC) - Introduction to sub synchronous resonance - thyristor-controlled braking resistor (TCBR)- Power system applications..                                    |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books:</b>   |   |                |           |
| 1.   | K.R.Padiyar, —Facts Controllers in Power Transmission and Distribution, New Age International, 1st Edition, 2007, Reprint August 2014, New Delhi.                               |                |           |
| 2.   | Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS concepts and Technology of Flexible AC Transmission Systems, Standard Publishers, Delhi 2001.                        |                |           |
| <b>References:</b>   |   |                |           |
| 1.   | R.MohanMathur, Rajiv.K.Varma, “Thyristor Based FACTS Controllers for Electrical Transmission systems” John Wiley and Sons, 2011.  |                |           |
| 2.   | Jos Arrillaga, Y. H. Liu, Neville R. Watson " Flexible Power Transmission: The HVDC Options”, Wiley 2007.   |                |           |
| 3.   | G. K. Dubey, Thyristorized Power Controller, New Age international (P) Ltd., New Delhi 2016.  |                |           |
| 4.   | T. J. E. Miller, Reactive Power Control in Electric System, John Wiley & Sons, 2014.  |                |           |
| <b>E-Resources:</b>  |   |                |           |
| 1.   | <a href="https://easyengineering.net/ee6004-flexible-ac-transmission-systems/">https://easyengineering.net/ee6004-flexible-ac-transmission-systems/</a>                         |                |           |
| 2.   | <a href="https://www.jbiet.edu.in/pdf/fls/EEE-Coursematerial/FACTS-IV-I-EEE.pdf">https://www.jbiet.edu.in/pdf/fls/EEE-Coursematerial/FACTS-IV-I-EEE.pdf</a>                     |                |           |
| 3.   | <a href="https://www.brainkart.com/subject/Flexible-AC-Transmission-Systems_183/">https://www.brainkart.com/subject/Flexible-AC-Transmission-Systems_183/</a>                   |                |           |
| 4.   | <a href="https://www.rejinpaul.com/2021/07/ee8011-facts-syllabus-notes-question-bank.html">https://www.rejinpaul.com/2021/07/ee8011-facts-syllabus-notes-question-bank.html</a> |                |           |
| 5.   | <a href="https://onlinecourses-archive.nptel.ac.in/noc18_ee44/preview">https://onlinecourses-archive.nptel.ac.in/noc18_ee44/preview</a>   |                |           |

|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |      |                |      |      |      |                  |      |            |        |  |                        |      |       |       |       |
|--|---|------|----------------|------|------|------|------------------|------|------------|--------|---|------------------------|------|-------|-------|-------|
| Programme  | <b>B.E.</b>   |      | Programme Code |      |      |      | <b>102</b>       |      | Regulation |        | <b>2019</b>   |                        |      |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |      |                |      |      |      | Semester         |      |            |        |   |                        |      |       |       |       |
| Course Code  | Course Name   |      |                |      |      |      | Periods Per Week |      |            | Credit | Maximum Marks   |                        |      |       |       |       |
|  |   |      |                |      |      |      | L                | T    | P          |        | C   | CA                     | ESE  | Total |       |       |
| <b>U19EEV16</b>  | <b>Utilization of Electrical Energy</b>   |      |                |      |      |      | 3                | 0    | 0          | 3      | 40  | 60                     | 100  |       |       |       |
| Course Objective   | <p>The students should made to</p> <ul style="list-style-type: none"> <li>• Design illumination systems, choose appropriate motors for any drive application, to debug the domestic electric wiring, heating, welding, and specific guidance of electric traction applications.</li> <li>• Orient the subject matter in the proper direction, visits to industrial establishments are recommended</li> <li>• Familiarize the students with the different electric energy appliances in different applications.</li> </ul> |      |                |      |      |      |                  |      |            |        |   |                        |      |       |       |       |
| Course Outcome   | At the end of the course, the student should be able to,  |      |                |      |      |      |                  |      |            |        |   | <b>Knowledge Level</b> |      |       |       |       |
|  | CO1: Identify an appropriate method of heating and welding for any particular industrial application.   |      |                |      |      |      |                  |      |            |        |   | K1                     |      |       |       |       |
|  | CO2: Develop a clear idea of various Illumination techniques and hence design a lighting scheme for specific applications.  |      |                |      |      |      |                  |      |            |        |   | K5                     |      |       |       |       |
|  | CO3: Evaluate domestic wiring connection and debug any faults occurred.   |      |                |      |      |      |                  |      |            |        |   | K2                     |      |       |       |       |
|  | CO4: Realize the appropriate type of electric supply system as well as to evaluate the performance of a traction unit, and description of various equipment accessories.  |      |                |      |      |      |                  |      |            |        |   | K5                     |      |       |       |       |
| CO5: Construct an electric connection for any domestic appliance like a refrigerator as well as to design a battery charging circuit for a specific household application. |   |      |                |      |      |      |                  |      |            |        | K3  |                        |      |       |       |       |
| Pre-requisites   |   |      |                |      |      |      |                  |      |            |        |   |                        |      |       |       |       |
| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |   |      |                |      |      |      |                  |      |            |        |   | CO/PSO Mapping         |      |       |       |       |
| COs  | Programme Outcomes (POs)  |      |                |      |      |      |                  |      |            |        |   | PSOs                   |      |       |       |       |
|  | PO 1  | PO 2 | PO 3           | PO 4 | PO 5 | PO 6 | PO 7             | PO 8 | PO 9       | PO 10  | PO 11   | PO 12                  | PSO1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3   | 2    | 3              | 2    | 3    | 2    | 2                |      | 2          |        | 1   | 1                      | 3    | 1     | 2     |       |
| CO 2   | 3   | 1    | 2              | 1    | 1    | 3    |                  |      |            |        | 2   | 1                      | 3    | 2     | 2     | 2     |
| CO 3   | 2   | 2    | 2              |      | 2    |      |                  |      |            |        | 1   | 3                      | 2    | 3     | 3     | 1     |
| CO 4   | 3   | 1    | 3              |      | 3    | 1    |                  | 1    |            |        |   |                        | 3    |       | 2     | 2     |
| CO 5   | 2   | 2    | 1              | 2    | 2    | 2    | 1                |      | 1          |        | 2   | 2                      | 3    | 2     | 2     |       |

| <b>Course Assessment Methods</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Direct</b>   |   |                |           |
| 1.Continuous Assessment Test I, II & III<br>2.Assignment<br>3.End-Semester examinations   |   |                |           |
| <b>Indirect</b>   |   |                |           |
| 1. Course – end Survey  |   |                |           |
| <b>Content of the syllabus</b>  |   |                |           |
| <b>Unit – I</b>   | <b>ELECTRIC HEATING &amp; WELDING</b>   | <b>Periods</b> | <b>9</b>  |
| Electric Heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric welding: resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.  |   |                |           |
| <b>Unit - II</b>  | <b>ILLUMINATION</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Electric lamps –Different types of lamps, LED lighting and Energy efficient lamps. Discharge lamps, MV and SV lamps, Basic principles of light control, Types and design of lighting and flood lighting- street lighting. |   |                |           |
| <b>Unit – III</b>   | <b>ELECTRICAL ENERGY APPLIANCES AND EARTHING</b>  | <b>Periods</b> | <b>9</b>  |
| Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries. Power quality aspects – nonlinear and domestic loads. Earthing – domestic, industrial and sub-station – Earthing Standards.   |   |                |           |
| <b>Unit - IV</b>  | <b>ELECTRIC DRIVES AND TRACTION</b>   | <b>Periods</b> | <b>9</b>  |
| Different types of electric traction- DC and AC systems, types of motors used for electric traction, electric braking, tractive effort calculations, and speed-time characteristics. Electrical block diagram of an electric locomotive with description of various equipment and accessories.  |   |                |           |
| <b>Unit – V</b>   | <b>ELECTRICAL CIRCUITS USED IN REFRIGERATION AND AIR CONDITIONING AND WATER COOLERS</b>   | <b>Periods</b> | <b>9</b>  |
| Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants Description of Electrical circuit used in a) refrigerator, b) air-conditioner, and c) water cooler   |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Rajput R.K., "Utilization of Electrical Power", Laxmi publications, 1st Edition, 2007.  |                |           |
| 2.  | H. Partab, "Art and Science of Utilization of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.  |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Dr. S. L. Uppal and Prof. S. Rao's Electrical Power Systems, published by Khanna Publishers, 1981.  |                |           |
| 2.  | E. Openshaw Taylor, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2013   |                |           |
| 3.  | Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana, 2011.   |                |           |
| 4.  | H Partab, "Modern electric traction (Including other applications of electrical engineering in railways). Delhi: Dhanpat Rai & Sons, 2017.  |                |           |
| 5.  | CL Wadhwa, "Generation, Distribution and Utilization of Electrical Power by, Wiley Eastern Ltd., New Delhi. 2014.   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses/108/105/108105060/">https://nptel.ac.in/courses/108/105/108105060/</a>   |                |           |
| 2.  | <a href="https://www.smartworld.com/notes/utilization-of-electrical-energy-pdf-notes-uee-pdf-notes/">https://www.smartworld.com/notes/utilization-of-electrical-energy-pdf-notes-uee-pdf-notes/</a> |                |           |
| 3.  | <a href="https://lecturenotes.in/subject/386/utilization-of-electric-energy">https://lecturenotes.in/subject/386/utilization-of-electric-energy</a>   |                |           |



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|   |  |                  |            |            |             |               |                        |       |
|---|--|------------------|------------|------------|-------------|---------------|------------------------|-------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                        |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |                        |       |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                        |       |
|   |  | L                | T          | P          | C           | CA            | ESE                    | Total |
| <b>U19EEV17</b>   | <b>EHV AC and DC Transmission</b>  | 3                | 0          | 0          | 3           | 40            | 60                     | 100   |
| <b>Course Objective</b>                                     | The students should made to <ul style="list-style-type: none"> <li>• Know the basic concepts of EHV AC and HVDC transmission.</li> <li>• Understand the operation of EHVAC and DC Transmission systems</li> <li>• Know the fault protective methods of EHVAC and DC systems</li> </ul> |                  |            |            |             |               |                        |       |
| <b>Course Outcome</b>                                       | At the end of the course, the student should be able to,   |                  |            |            |             |               | <b>Knowledge Level</b> |       |
|   | <b>CO1:</b> Understand the importance of HVDC Transmission and HVDC Converters   |                  |            |            |             |               | K2                     |       |
|   | <b>CO2:</b> Understand the operation of EHVAC Transmission systems.  |                  |            |            |             |               | K2                     |       |
|   | <b>CO3:</b> Understand the testing of EHVAC and DC Transmission systems  |                  |            |            |             |               | K2                     |       |
|   | <b>CO4:</b> Understand control of HVDC System  |                  |            |            |             |               | K2                     |       |
| <b>CO5:</b> Understand the protection methods of EHV system |  |                  |            |            |             | K2            |                        |       |
| <b>Pre-requisites</b>                                       | Power system analysis,, FACTS devices  |                  |            |            |             |               |                        |       |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 2                        | 2    | 2    | 2    | 2    |      |      |      |      |       |       | 2     | 2                     | 2     |       | 2     |
| CO 2   | 3                        | 2    | 2    |      |      |      |      |      |      |       |       | 2     | 2                     | 2     | 2     |       |
| CO 3   | 3                        | 2    | 2    | 2    | 2    |      |      |      |      |       |       |       | 2                     |       | 2     | 2     |
| CO 4   | 3                        | 2    | 2    | 2    | 2    |      |      |      |      |       |       |       | 2                     | 2     |       | 2     |
| CO 5   | 3                        | 2    | 2    | 2    |      |      |      |      |      |       |       |       | 2                     | 2     |       | 2     |

**Course Assessment Methods**

**Direct**

1. Continuous Assessment Test I, II &III
2. Assignment
3. End-Semester examinations

**Indirect**

1. Course – end Survey

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>Introduction</b>   | <b>Periods</b> | <b>9</b>  |
| Need of EHV transmission, standard transmission voltage, comparison of EHV AC & DC transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC & DC transmission.                       |   |                |           |
| <b>Unit – II</b>   | <b>EHV AC Transmission</b>  | <b>Periods</b> | <b>9</b>  |
| Corona loss formulas, corona current, audible noise- generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, overvoltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.  |   |                |           |
| <b>Unit – III</b>  | <b>Extra High Voltage Testing</b>   | <b>Periods</b> | <b>9</b>  |
| Characteristics and generation of impulse voltage, generation of high AC and DC voltages, measurement of high voltage by sphere gaps and potential dividers. Consideration for Design of EHV Lines, Design factors under steady state limits, EHV line insulation design based upon transient overvoltage. Effects of pollution on performance of EHV lines. |   |                |           |
| <b>Unit – IV</b>   | <b>EHV DC Transmission-I</b>  | <b>Periods</b> | <b>9</b>  |
| Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters, principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of d dcl ink.                           |   |                |           |
| <b>Unit – V</b>  | <b>EHV DC Transmission- II</b>  | <b>Periods</b> | <b>9</b>  |
| Converter faults, protection against over currents and over voltage, Smoothing reactors, generation of harmonics, ac and dc filters, multi –terminal dc systems (MTDC): Types, control, protection and application.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | R. D. Begamudre, “Extra High Voltage AC Transmission Engineering” Wiley Eastern 1997.   |                |           |
| 2.   | S .Rao, “EHV AC & HVDC Transmission Engineering and practice” Khanna Publishers, 2013.  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | J. Arrillaga, “ High Voltage Direct current Transmission” IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London. 1986.  |                |           |
| 2.   | Kim Chan Ki “Hvdc Transmission Power Conversation Applications In Power Systems”, John Wiley, 2001                              |                |           |
| 3.   | Uhlmann “Power Transmission By Direct Current”, Springer India Private Ltd, 2008  |                |           |
| 4.   | Arrillaga Jos “Flexible Power Transmission”, WILEY 2007.  |                |           |
| 5.   | M. S. Naidu & V. Kamaraju, “High Voltage Engineering” Tata Mc Graw Hill 2012.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/108/108/108108099/">https://nptel.ac.in/courses/108/108/108108099/</a>                     |                |           |
| 2.   | <a href="https://nptel.ac.in/courses/108/104/108104013/">https://nptel.ac.in/courses/108/104/108104013/</a>                     |                |           |
| 3.   | <a href="https://www.youtube.com/playlist?list=PL4B78E9972172086A">https://www.youtube.com/playlist?list=PL4B78E9972172086A</a> |                |           |





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|  |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
|--|---|------------------|-------------|-------------|-------------|---------------|------------------------|-------------|-------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b>  | Regulation  | <b>2019</b> |               |                        |             |             |              |              |              |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             | Semester    |             |               |                        |             |             |              |              |              |                       |              |              |              |
| Course Code  | Course Name   | Periods Per Week |             |             | Credit      | Maximum Marks |                        |             |             |              |              |              |                       |              |              |              |
|  |   | L                | T           | P           |             | C             | CA                     | ESE         | Total       |              |              |              |                       |              |              |              |
| <b>U19EEV18</b>  | <b>Static Relays</b>  | 3                | 0           | 0           | 3           | 40            | 60                     | 100         |             |              |              |              |                       |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Understand the construction of static relays</li> <li>Understand the operation of amplitude and phase comparators</li> <li>Comprehend the concepts of Static over current, static differential and static distance relays.</li> <li>Understand multi-input comparators and concept of power swings on the distance relays.</li> <li>Understand the operation of microprocessor based protective relays.</li> </ul> |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |             |             |             |               | <b>Knowledge Level</b> |             |             |              |              |              |                       |              |              |              |
|  | <b>CO1:</b> Describe the construction of static relay and identify the advantages of static relay over electromagnetic relay.   |                  |             |             |             |               | K2                     |             |             |              |              |              |                       |              |              |              |
|  | <b>CO2:</b> Explore the operation of rectifier bridge comparators, instantaneous comparators, phase comparators, multi input comparators, static differential and distance relays   |                  |             |             |             |               | K2                     |             |             |              |              |              |                       |              |              |              |
|  | <b>CO3:</b> Describe instantaneous, definite time and inverse definite minimum time over current relays   |                  |             |             |             |               | K2                     |             |             |              |              |              |                       |              |              |              |
|  | <b>CO4:</b> Analyze the concept of power swings   |                  |             |             |             |               | K4                     |             |             |              |              |              |                       |              |              |              |
| <b>CO5:</b> Understand the microprocessor based protective relays                                  |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| <b>Pre-requisites</b>  | U19EE517-Power System Protection and Switchgear   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |   |                  |             |             |             |               |                        |             |             |              |              |              | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)  |                  |             |             |             |               |                        |             |             |              |              |              | PSOs                  |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b>            | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 2                | 3           | 2           | 2           | -             | -                      | -           | -           | -            | 2            | 2            | 3                     | -*           | 2            | 3            |
| <b>CO 2</b>  | 3   | 2                | 2           | 2           | 2           | -             | -                      | -           | -           | -            | 2            | 2            | 3                     | -            | 2            | 3            |
| <b>CO 3</b>  | 3   | 2                | 2           | 2           | 2           | -             | -                      | -           | -           | -            | 3            | 3            | 3                     | -            | 2            | 3            |
| <b>CO 4</b>  | 3   | 2                | 2           | 2           | 2           | -             | -                      | -           | -           | -            | 3            | 3            | 3                     | -            | 3            | 3            |
| <b>CO 5</b>  | 2   | 2                | 2           | 2           | 2           | -             | -                      | -           | -           | -            | 3            | 3            | 3                     | -            | 3            | 3            |
| <b>Course Assessment Methods</b>   |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| <b>Direct</b>  |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations         |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| <b>Indirect</b>  |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |
| 1. Course - end Survey   |   |                  |             |             |             |               |                        |             |             |              |              |              |                       |              |              |              |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>UNIT – I</b>  | <b>STATIC RELAYS</b>  | <b>Periods</b> | <b>9</b>  |
| Advantages of static relays – Basic construction of static relays – Level detectors – Replica impedance – Mixing circuits – General equation for two input phase and amplitude comparators -Duality between amplitude and phase comparators. Amplitude Comparators: Circulating current type and opposed voltage type – rectifier bridge comparators, Direct and Instantaneous comparators.  |   |                |           |
| <b>Unit - II</b>   | <b>PHASE COMPARATORS</b>  | <b>Periods</b> | <b>9</b>  |
| Coincidence circuit type – block spike phase comparator, techniques to measure the period of coincidence – Integrating type – Rectifier and Vector product type – Phase comparators. Static Over Current Relays: Instantaneous over-current relay – Time over-current relays-basic principles – definite time and Inverse definite time over-current relays.   |   |                |           |
| <b>Unit – III</b>  | <b>STATIC DIFFERENTIAL RELAYS</b>   | <b>Periods</b> | <b>9</b>  |
| Analysis of Static Differential Relays – Static Relay schemes – Duo bias transformer differential protection – Harmonic restraint relay. Static Distance Relays: Static impedance-reactance – MHO and angle impedance relay-sampling comparator – realization of reactance and MHO relay using sampling comparator.  |   |                |           |
| <b>UNIT - IV</b>   | <b>MULTI-INPUT COMPARATORS</b>  | <b>Periods</b> | <b>9</b>  |
| Conic section characteristics -Three input amplitude comparator – comparator-switched distance schemes – Poly phase distance schemes – phase fault scheme – three phase scheme – combined and ground fault scheme. Power Swings: Effect of power swings on the performance of distance relays – Power swing analysis – Principle of out of step tripping and blocking relays – effect of line and length and source impedance on distance relays |   |                |           |
| <b>UNIT – V</b>  | <b>MICROPROCESSOR BASED PROTECTIVE RELAYS</b>   | <b>Periods</b> | <b>9</b>  |
| (Block diagram and flowchart approach only) – Over current relays – impedance relays – directional relay – reactance relay – Generalized mathematical expressions for distance relays -measurement of resistance and reactance – MHO and offset MHO relays – Realization of MHO characteristics – Realization of offset MHO characteristics – Basic principle of Digital computer relaying.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Badri Ram and D. N. Vishwakarma, “Power system protection and Switch gear “, TMH publication New Delhi 1995.  |                |           |
| 2.   | T. S. Madhava Rao “Power System Protection: Static Relays”, TMH publication,2008.   |                |           |
| 3.   | Ravindranath.B and chander.M, “Power System Protection AndSwitchgear”New Age International Publishers 2018.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | BhaveshBhalja, R. P. Maheshwari, Nilesh G. Chothani“Protection and Switchgear” , Oxford University Press,2010.  |                |           |
| 2.   | C. Christopoulos and A. Wright “Electrical Power System Protection,, Springer International   |                |           |
| 3.   | J.B.Gupta, “Switchgear and Protection” S.K. Kataria& Sons2013.  |                |           |
| 4.   | Bhuvaneshoza ,Nirmalkumar,Rashesh Mehta “Power System Protection & Switchgear,1st Edition,2012.   |                |           |
| 5.   | Sunil S.Rao, “Switch Gear and Protection”, Khanna Publication   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://www.bharathuniv.ac.in/colleges1/downloads/courseware_eee/Notes/CE1/BEE012%20SOL_ID%20STATE%20RELAYS.pdf">https://www.bharathuniv.ac.in/colleges1/downloads/courseware_eee/Notes/CE1/BEE012%20SOL_ID%20STATE%20RELAYS.pdf</a> |                |           |
| 2.   | <a href="http://www.miet.edu/course/wp-content/uploads/2019/07/4.7-PASG_Optimized.pdf">http://www.miet.edu/course/wp-content/uploads/2019/07/4.7-PASG_Optimized.pdf</a>   |                |           |
| 3.   | <a href="https://www.studocu.com/row/document/tribhuvan-vishwavidalaya/switchgear-and-protection/static-relay-4/12574437">https://www.studocu.com/row/document/tribhuvan-vishwavidalaya/switchgear-and-protection/static-relay-4/12574437</a> |                |           |

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|--|--|------------------|------|------|--------|---------------|------------|------------|------|-------------|-------|---|-----------------------|------|------|------|
| Programme  | <b>B.E.</b>  | Programme Code   |      |      |        |               | <b>102</b> | Regulation |      | <b>2019</b> |       |   |                       |      |      |      |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      |        | Semester      |            |            |      |             |       |   |                       |      |      |      |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit | Maximum Marks |            |            |      |             |       |   |                       |      |      |      |
|  |  | L                | T    | P    | C      | CA            | ESE        | Total      |      |             |       |   |                       |      |      |      |
| <b>U19EEV21</b>  | <b>Solid State Drives</b>  | 3                | 0    | 0    | 3      | 40            | 60         | 100        |      |             |       |   |                       |      |      |      |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Steady state operation and transient dynamics of a motor load system.</li> <li>Analyze the operation of the converter/chopper fed dc drives</li> <li>Familiarize on the operation of VSI and CSI fed induction motor drives.</li> <li>Operation and performance of Synchronous motor drives.</li> <li>Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.</li> </ul> |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |      |      |        |               |            |            |      |             |       | Knowledge Level   |                       |      |      |      |
|  | <b>CO1:</b> Understand the basic concepts of Electrical drives   |                  |      |      |        |               |            |            |      |             |       | K2  |                       |      |      |      |
|  | <b>CO2:</b> Analyze the power electronic converters fed DC Drives  |                  |      |      |        |               |            |            |      |             |       | K3  |                       |      |      |      |
|  | <b>CO3:</b> Expertise in the control of Induction motor drives   |                  |      |      |        |               |            |            |      |             |       | K4  |                       |      |      |      |
|  | <b>CO4:</b> Analyze the converter fed synchronous drives under different torque/speed conditions.  |                  |      |      |        |               |            |            |      |             |       | K4  |                       |      |      |      |
| <b>CO5:</b> Formulate the control schemes for Electrical Drives.                                   |  |                  |      |      |        |               |            |            |      |             | K4    |   |                       |      |      |      |
| <b>Pre-requisites</b>  | U19EE519 - Power Electronics   |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |  |                  |      |      |        |               |            |            |      |             |       |   | <b>CO/PSO Mapping</b> |      |      |      |
| <b>Cos</b>   | Programme Outcomes (Pos)   |                  |      |      |        |               |            |            |      |             |       |   | PSOs                  |      |      |      |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5   | PO 6          | PO 7       | PO 8       | PO 9 | PO 10       | PO 11 | PO 12   | PSO1                  | PSO2 | PSO3 | PSO4 |
| <b>CO 1</b>  | 2  | 2                | 2    | 2    | 2      | -             | -          | -          | -    | -           | -     | 2   | 3                     | -    | 2    | 2    |
| <b>CO 2</b>  | 2  | 2                | 2    | 2    | 2      | -             | -          | -          | -    | -           | -     | 2   | 2                     | -    | 2    | 2    |
| <b>CO 3</b>  | 2  | 2                | 2    | 2    | 2      | -             | -          | -          | -    | -           | -     | 2   | 2                     | -    | 2    | 2    |
| <b>CO 4</b>  | 2  | 2                | 2    | 2    | 2      | -             | -          | -          | -    | -           | -     | 2   | 2                     | -    | 3    | 2    |
| <b>CO 5</b>  | 2  | 2                | -    | 2    | 2      | -             | -          | -          | -    | -           | -     | 2   | 2                     | -    | 2    | 2    |
| <b>Course Assessment Methods</b>   |  |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |
| <b>Direct</b>  |  |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations         |  |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |
| <b>Indirect</b>  |  |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |
| 1.Course – end survey  |  |                  |      |      |        |               |            |            |      |             |       |   |                       |      |      |      |



| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>DRIVE CHARACTERISTICS</b>  | Periods | <b>9</b>  |
| Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant, Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor – Choice of Electric Drives and Losses |   |         |           |
| <b>Unit – II</b>  | <b>CONVERTER / CHOPPER FED DC MOTOR DRIVE</b>   | Periods | <b>9</b>  |
| Steady state analysis of the single and three phase converter fed separately excited DC motor drive–continuous and discontinuous conduction– Time ratio and current limit control – 4 quadrant operation of chopper fed DC drives.                              |   |         |           |
| <b>Unit – III</b>   | <b>INDUCTION MOTOR DRIVES</b>   | Periods | <b>9</b>  |
| Speed Control using Stator voltage control—v/f control–Rotor side Control – constant air gap flux–field weakening mode – voltage / current fed inverter – closed loop control- energy efficient drive   |   |         |           |
| <b>Unit – IV</b>  | <b>SYNCHRONOUS MOTOR DRIVES</b>   | Periods | <b>9</b>  |
| V/f control and self-control of synchronous motor: Margin angle control and power factor control – permanent magnet synchronous Motor-Three phase voltage/current source fed synchronous motor  |   |         |           |
| <b>Unit – V</b>   | <b>CONTROLLERS FOR DRIVES</b>   | Periods | <b>9</b>  |
| Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode –current controller and speed controller- converter selection and characteristics.                  |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | G.K. Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing house, 2 <sup>nd</sup> edition, 2008.  |         |           |
| 2.  | R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2010.  |         |           |
| 3.  | B.K. Bose,” Modern Power Electronics and AC drives”, Pearson Education Publications, 2 <sup>nd</sup> edition 2005.  |         |           |
| 4   | Vinod Kumar, Ranjan Kumar Behera, Dheeraj Joshi, “Power Electronics, Drives, and Advanced Applications” CRC Press, 2020.  |         |           |
| <b>References</b>   |   |         |           |
| 1.  | T. Wildi, „Electrical Machines Drives and Power Systems“, Pearson Education Publications, 6 <sup>th</sup> edition, 2004.  |         |           |
| 2.  | P.C. Sen,” Thyristor DC Drives“ John Wiley& Sons Publishers, New York, 2008   |         |           |
| 3.  | John Hindmarsh and Alasdain Renfrew, “Electrical Machines and Drives System,” Elsevier 2012.  |         |           |
| 4   | Vedam Subramanyam, Electric Drives Concepts and Application, 2e, McGraw Hill, 2016  |         |           |
| 5   | Theodore Wildi, Electrical Machines, Drives and power systems ,6th edition, Pearson Education ,2015   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1   | <a href="https://archive.org/details/Dynamics_and_Control_of_Electrical_Drives/page/n11/mode/2up">https://archive.org/details/Dynamics_and_Control_of_Electrical_Drives/page/n11/mode/2up</a>   |         |           |
| 2   | <a href="https://onlinecourses.nptel.ac.in/noc19_ee65/preview">https://onlinecourses.nptel.ac.in/noc19_ee65/preview</a>   |         |           |
| 3   | <a href="https://www.pdfdrive.com/electrical-machines-and-drives-fundamentals-and-advanced-modelling-e158453884.html">https://www.pdfdrive.com/electrical-machines-and-drives-fundamentals-and-advanced-modelling-e158453884.html</a> |         |           |



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|                         |  |                  |            |            |             |               |                        |     |
|-------------------------|--|------------------|------------|------------|-------------|---------------|------------------------|-----|
| Programme               | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                        |     |
| Department              | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |                        |     |
| Course Code             | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                        |     |
|                         |  | L                | T          | P          |             | C             | CA                     | ESE |
| <b>U19EEV22</b>         | <b>Special Electrical Machines</b>   | 3                | 0          | 0          | 3           | 40            | 60                     | 100 |
| <b>Course Objective</b> | The students should made to <ul style="list-style-type: none"> <li>Understand the constructional features and operating principles of various types of special electrical machines.</li> <li>Analyze the static and dynamic characteristics of special electrical machines.</li> <li>Understand about the different types of drive systems and controllers used in special electrical machines.</li> </ul> |                  |            |            |             |               |                        |     |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               | <b>Knowledge Level</b> |     |
|                         | <b>CO1:</b> Explicate the construction and operating principles of Synchronous Reluctance Motors.  |                  |            |            |             |               | K2                     |     |
|                         | <b>CO2:</b> Analyze the characteristics and performance of Permanent Magnet Synchronous Motors.  |                  |            |            |             |               | K3                     |     |
|                         | <b>CO3:</b> Analyze the different types of controllers and control techniques of Permanent Magnet Brushless Dc Motors.   |                  |            |            |             |               | K3                     |     |
|                         | <b>CO4:</b> Explicate the construction and operating principles of Switched Reluctance Motors.   |                  |            |            |             |               | K2                     |     |
|                         | <b>CO5:</b> Explicate the construction and operating principles of Steeping motors.  |                  |            |            |             |               | K2                     |     |
| <b>Pre-requisites</b>   | U19EE411 - AC Machines   |                  |            |            |             |               |                        |     |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3                        | 2    | 3    | 2    | -    | 2    | -    | -    | -    | -     | 2     | 3     | 3                     | -     | 2     | 2     |
| CO 2   | 3                        | 2    | 3    | 2    | -    | 2    | -    | -    | -    | -     | 2     | 3     | 3                     | -     | 2     | 2     |
| CO 3   | 3                        | 2    | 3    | 2    | -    | 2    | -    | -    | -    | -     | 2     | 3     | 3                     | -     | 2     | 2     |
| CO 4   | 3                        | 2    | 3    | 2    | -    | 2    | -    | -    | -    | -     | 2     | 3     | 3                     | -     | 2     | 2     |
| CO 5   | 3                        | 2    | 3    | 2    | -    | 2    | -    | -    | -    | -     | 2     | 3     | 3                     | -     | 2     | 2     |

**Course Assessment Methods**



**Direct**

- Continuous Assessment Test I, II &III
- Assignment
- End-Semester examinations

**Indirect**

- Course - end survey

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>SYNCHRONOUS RELUCTANCE MOTORS</b>  | <b>Periods</b> | <b>9</b>  |
| Constructional features: axial and radial air gap Motors - Operating principle - reluctance torque – phasor diagram - motor characteristics – Applications: SRM for Electric ships.  |   |                |           |
| <b>Unit - II</b>   | <b>PERMANENT MAGNET SYNCHRONOUS MOTORS</b>  | <b>Periods</b> | <b>9</b>  |
| Permanent Magnet operating principle and it characteristics, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self-control, Vector control, Current control schemes- Sensor less control-Applications: PMSM for Railway vehicles.   |   |                |           |
| <b>Unit – III</b>  | <b>PERMANENT MAGNET BRUSHLESS DC MOTORS</b>   | <b>Periods</b> | <b>9</b>  |
| Commutation in DC motors- Difference between mechanical and electronic commutators- Hall sensors, Optical sensors- Multiphase Brushless motor- Square wave- Sine wave permanent magnet brushless motor drives, Torque and EMF equation, Torque-speed characteristics, Controllers-Microprocessor based controller-Applications: PMSM motor for motion control systems. |   |                |           |
| <b>Unit - IV</b>   | <b>SWITCHED RELUCTANCE MOTORS</b>   | <b>Periods</b> | <b>9</b>  |
| Constructional features-principle of operation-Torque equation - Power Controllers-Characteristics and control Microprocessor based controller-Applications: SRM for Hybrid Electric Vehicles.   |   |                |           |
| <b>Unit – V</b>  | <b>STEPPING MOTORS</b>  | <b>Periods</b> | <b>9</b>  |
| Constructional features, principle of operation, modes of excitation torque production in Variable Reluctance (VR) stepping motor, dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor- Applications: Stepper motor for Computer Printers.   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Janardanan E.G., —Special Electrical Machines, 1st Edition, PHI Learning Pvt.Ltd., New Delhi, 2014 .  |                |           |
| 2.   | Venkataratnam, “Special Electrical Machines”, Tayler and Francis, 2009  |                |           |
| 3.   | Simmi P Burman “Special Electrical Machines” ,S.K. Kataria& Sons,2nd edition, 2017.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Kenjo T., —Stepping Motors and Their Microprocessor Controls, 1st Edition, Oxford University Press, New Delhi, 2000.  |                |           |
| 2.   | Miller.T.J.E, “Brushless Permanent Magnet and Reluctance motor drives”,Clarendon Press, Oxford University, 1989.  |                |           |
| 3.   | Kenjo.T and Naganori.S, “Permanent Magnet and brushless DC motors”,Clarendon Press, Oxford University, 1990.  |                |           |
| 4.   | Krishnan.R, “Electric Motor Drives – Modeling, Analysis and Control”, PrenticeHall of India Private Limited, New Delhi, 2010                                      |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://www.coursehero.com/file/106572025/Special-Electrical-Machinesppt/">https://www.coursehero.com/file/106572025/Special-Electrical-Machinesppt/</a> |                |           |
| 2.   | <a href="https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SEE1307.pdf">https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SEE1307.pdf</a>         |                |           |
| 3.   | <a href="https://pdfslide.net/documents/special-electrical-machines-ppt.html">https://pdfslide.net/documents/special-electrical-machines-ppt.html</a>             |                |           |

|  |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
|--|--|------------------|------|------|------------|---|--------|-----------------|-------|-------|-------|-------|-----------------------|-------|-------|-------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205    |                  |      |      |            |  |        |                 |       |       |       |       |                       |       |       |       |
| Programme  | <b>B.E.</b>  | Programme Code   |      |      | <b>102</b> | Regulation  |        | <b>2019</b>     |       |       |       |       |                       |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      | Semester   |   |        |                 |       |       |       |       |                       |       |       |       |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit     | Maximum Marks   |        |                 |       |       |       |       |                       |       |       |       |
|  |  | L                | T    | P    |            | C   | CA     | ES<br>E         | Total |       |       |       |                       |       |       |       |
| <b>U19EEV23</b>  | <b>Electrical and Hybrid Vehicles</b>  | 3                | 0    | 0    | 3          | 40  | 6<br>0 | 100             |       |       |       |       |                       |       |       |       |
| <b>Course Objective</b>  | To introduce the fundamental concepts and principles of various Hybrid Electric Vehicle technologies with an insight into Power electronic converters and topologies |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |      |      |            |   |        | Knowledge Level |       |       |       |       |                       |       |       |       |
|  | <b>CO1:</b> Explain about concept of electric and hybrid electric vehicles   |                  |      |      |            |   |        | K2              |       |       |       |       |                       |       |       |       |
|  | <b>CO2:</b> Distinguish the characteristics of internal combustion vehicles and hybrid electric vehicles   |                  |      |      |            |   |        | K3              |       |       |       |       |                       |       |       |       |
|  | <b>CO3:</b> Demonstrate the concept of electrically coupled hybrid electric drive trains   |                  |      |      |            |   |        | K2              |       |       |       |       |                       |       |       |       |
|  | <b>CO4:</b> Illustrate the concept of mechanically coupled hybrid electric drive trains  |                  |      |      |            |   |        | K3              |       |       |       |       |                       |       |       |       |
| <b>CO5:</b> Outline the importance of regenerative braking   |  |                  |      |      |            |   | K3     |                 |       |       |       |       |                       |       |       |       |
| <b>Pre-requisites</b>  | Basic principles of Electric Motors  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                  |      |      |            |   |        |                 |       |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |      |      |            |   |        |                 |       |       |       |       | PSOs                  |       |       |       |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5       | PO 6  | PO 7   | PO 8            | PO 9  | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3  | 2                | 1    | 1    |            |   |        |                 |       |       |       |       | 2                     |       | 1     | 3     |
| CO 2   | 3  | 2                | 1    | 1    |            |   |        |                 |       |       |       |       | 3                     | 2     | 2     | 2     |
| CO 3   | 3  | 2                | 1    | 1    |            |   |        |                 |       |       |       |       | 3                     | 2     | 1     | 2     |
| CO 4   | 3  | 1                |      |      |            |   |        |                 |       |       |       |       | 3                     |       |       | 3     |
| CO 5   | 3  | 2                | 1    | 1    |            |   |        |                 |       |       |       |       | 2                     | 1     | 2     | 3     |
| <b>Course Assessment Methods</b>   |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| <b>Direct</b>  |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| 1. Continuous Assessment Test I, II & III  |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| 2. Assignment  |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| 3. End-Semester examinations   |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| <b>Indirect</b>  |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |
| 1. Course - end survey   |  |                  |      |      |            |   |        |                 |       |       |       |       |                       |       |       |       |

| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>INTRODUCTION</b>   | Periods | <b>9</b>  |
| Environmental impact and history of modern transportation – Electric vehicles: configuration of EVs- performance of EVs – Tractive effort in normal driving- energy consumption – Hybrid electric vehicles: concept of hybrid electric drive trains – Architecture of hybrid electric drive trains  |   |         |           |
| <b>Unit - II</b>  | <b>IC PROPULSION AND ELECTRIC PROPULSION SYSTEMS</b>  | Periods | <b>9</b>  |
| Vehicle power plant and transmission characteristics – IC engine operating principle- operation parameters – DC Motor Drives – Induction Motor Drives – Permanent Magnetic BLDC Motor Drives – SRM Drives..   |   |         |           |
| <b>Unit – III</b>   | <b>ELECTRICALLY COUPLED HYBRID ELECTRIC DRIVE TRAIN</b>   | Periods | <b>9</b>  |
| Design principle of series (electrical coupling) hybrid electric drive train: Operation patterns – Control strategies – Design principles of a series (electrical coupling) hybrid drive train – Design example: Design of traction motor size – Design of the gear ratio – Verification of acceleration performance – Design of the power capacity of PPS – Fuel Consumption                                       |   |         |           |
| <b>Unit - IV</b>  | <b>MECHANICALLY COUPLED HYBRID ELECTRIC DRIVE TRAIN</b>   | Periods | <b>9</b>  |
| Parallel (mechanically coupled) hybrid electric drive train design: Drive train configuration and design objectives – Control strategies – parametric design of a drive train – Design and control methodology of series – parallel (torque and speed coupling) hybrid drive train: Drive train configuration – drive train control methodology – design and control principles of plug-in hybrid electric vehicles |   |         |           |
| <b>Unit – V</b>   | <b>FUNDAMENTALS OF REGENERATIVE BRAKING</b>   | Periods | <b>9</b>  |
| Braking energy consumed in urban driving – braking energy versus vehicle speed – braking energy versus braking power – braking power versus vehicle speed – braking energy versus vehicle deceleration rate – braking energy on front and rear axles – brake system of EV, HEV, and FCV.  |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | Mehrded Ehsani, Yimin Gao & Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2nd Edition, CRC Press , USA, 2010. |         |           |
| <b>References</b>   |   |         |           |
| 1.  | Iqbal Hussain, Electric and Hybrid Vehicles design fundamentals” Third Edition, CRC Press 2018.   |         |           |
| 2.  | Chris Mi, Abdul Masrur and David Wenzhong Gao,Hybrid Electric Vehicles, Principles and Applications with Practical Perspectives, Wiley Press. 2018                      |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | NPTEL Course on “ Electric Vehicles Part – 1”   |         |           |
| 2.  | NPTEL Course on “Electric Vehicles and Renewable Energy”  |         |           |



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|  |   |                  |            |            |             |               |                        |       |
|--|---|------------------|------------|------------|-------------|---------------|------------------------|-------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                        |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   |             |               |                        |       |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |                        |       |
|  |   | L                | T          | P          | C           | CA            | ESE                    | Total |
| <b>U19EEV24</b>                                      | <b>Design of Electrical Apparatus</b>   | 3                | 0          | 0          | 3           | 40            | 60                     | 100   |
| <b>Course Objective</b>                              | The students should made to <ul style="list-style-type: none"> <li>• Magnetic circuit parameters and thermal rating of various types of electrical machines</li> <li>• Core, yoke, windings and cooling systems of transformers.</li> <li>• Armature and field systems for D.C. machines.</li> <li>• Design of stator and rotor of induction machines and its operating characteristics</li> <li>• Design stator and rotor of synchronous machines</li> </ul> |                  |            |            |             |               |                        |       |
| <b>Course Outcome</b>                                | At the end of the course, the student should be able to,  |                  |            |            |             |               | <b>Knowledge Level</b> |       |
|  | <b>CO1:</b> Understand the basics of design considerations and mmf calculation  |                  |            |            |             |               | K2                     |       |
|  | <b>CO2:</b> Design single and three phase transformer   |                  |            |            |             |               | K3                     |       |
|  | <b>CO3:</b> Design field and armature of DC machines.   |                  |            |            |             |               | K3                     |       |
|  | <b>CO4:</b> Design stator and rotor of induction motor and understand the operational performance.  |                  |            |            |             |               | K3                     |       |
| <b>CO5:</b> Design and analyze synchronous machines. |   |                  |            |            |             | K3            |                        |       |
| <b>Pre-requisites</b>                                | Basic concepts of magnetic fields and knowledge in electrical machines  |                  |            |            |             |               |                        |       |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3                        | 2    | 2    |      |      |      |      |      |      |       |       | 2     | 3              |       | 2     |       |
| CO 2  | 3                        | 3    | 2    |      |      |      |      |      |      |       |       | 2     | 3              | 2     | 2     |       |
| CO 3  | 3                        | 3    | 2    |      |      |      |      |      |      |       |       | 2     | 3              | 2     | 3     |       |
| CO 4  | 3                        | 2    |      |      |      |      |      |      |      |       |       | 2     | 3              |       | 2     |       |
| CO 5  | 3                        | 2    |      | 2    |      |      |      |      |      |       |       | 2     | 3              |       | 2     |       |

**Course Assessment Methods**

|   |
|---|
| <b>Direct</b>                             |
| 1. Continuous Assessment Test I, II & III |
| 2. Assignment                             |
| 3. End-Semester examinations              |
| <b>Indirect</b>                           |
| 1. Course – end Survey                    |

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>MAGNETIC CIRCUITS</b>  | <b>Periods</b> | <b>9</b>  |
| Major considerations in Electrical Machine Design – Materials for Electrical apparatus –MMF calculation for various types of electrical machines – real and apparent flux density of rotating machines - Flux leakage – Leakage in Armature - rating of electrical machines.          |   |                |           |
| <b>Unit - II</b>  | <b>TRANSFORMERS</b>   | <b>Periods</b> | <b>9</b>  |
| Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. |   |                |           |
| <b>Unit – III</b>   | <b>DC MACHINES</b>  | <b>Periods</b> | <b>9</b>  |
| Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – losses and efficiency calculations -Design of field system.  |   |                |           |
| <b>Unit - IV</b>  | <b>INDUCTION MOTORS</b>   | <b>Periods</b> | <b>9</b>  |
| Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram           |   |                |           |
| <b>Unit – V</b>   | <b>SYNCHRONOUS MACHINES</b>   | <b>Periods</b> | <b>9</b>  |
| Output equations – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators                  |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Sawhney, A.K., „A Course in Electrical Machine Design“, Dhanpat Rai & Sons, New Delhi, Fifth Edition, 2010.   |                |           |
| 2.  | S.K. Sen, „Principles of Electrical Machine Design with Computer Programmes“, Oxford and IBH Publishing Co. Pvt Ltd., New Delhi, 2006.  |                |           |
| <b>References</b>   |   |                |           |
| 1.  | R.K. Agarwal, „Principles of Electrical Machine Design“, S.K. Kataria and Sons, Delhi, 2002.  |                |           |
| 2.  | V.N. Mittle and A. Mittle, „Design of Electrical Machines“, Standard Publications and Distributors, Delhi, 2002.  |                |           |
| 3.  | A. Shanmugasundaram, G. Gangadharan, R. Palani, „Electrical Machine Design Data Book“, New Age International Pvt. Ltd., Reprint 2007.   |                |           |
| 4.  | M.V. Deshpande, „Design and Testing of Electrical Machines“ PHI Learning Pvt Ltd, 2011.   |                |           |
| 5.  | V Rajini, V.S Nagarajan, „Electrical Machine Design“, Pearson, 2017   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses/108/106/108106023/">https://nptel.ac.in/courses/108/106/108106023/</a>   |                |           |
| 2.  | <a href="https://freevidelectures.com/course/3527/modelling-and-analysis-of-electric-machines">https://freevidelectures.com/course/3527/modelling-and-analysis-of-electric-machines</a> |                |           |
| 3.  | <a href="https://www.youtube.com/watch?v=AECBgmkWvo0">https://www.youtube.com/watch?v=AECBgmkWvo0</a>   |                |           |

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|--|--|------|----------------|------------------|------|------|------------|---------------|------------|-------|-------------|---|-----------------------|------|------|------|
| Programme  | <b>B.E.</b>  |      | Programme Code |                  |      |      | <b>102</b> |               | Regulation |       | <b>2019</b> |   |                       |      |      |      |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |      |                |                  |      |      | Semester   |               |            |       |             |   |                       |      |      |      |
| Course Code  | Course Name  |      |                | Periods Per Week |      |      | Credit     | Maximum Marks |            |       |             |   |                       |      |      |      |
|  |  |      |                | L                | T    | P    | C          | CA            |            | ESE   | Total       |   |                       |      |      |      |
| <b>U19EEV25</b>  | <b>Wind and Solar Energy Systems</b>   |      |                | 3                | 0    | 0    | 3          | 40            |            | 60    | 100         |   |                       |      |      |      |
| <b>Course Objective</b>  | The student should be made to, <ul style="list-style-type: none"> <li>• Understand the physics of wind power and energy</li> <li>• Understand the principle of operation of wind generators</li> <li>• Understand the solar power resources</li> <li>• Analyse the solar photo-voltaic cells</li> <li>• Discuss the solar thermal power generation</li> <li>• Identify the network integration issues</li> </ul> |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |
|  | At the end of the course, the student should be able to,   |      |                |                  |      |      |            |               |            |       |             | Knowledge Level   |                       |      |      |      |
| <b>Course Outcome</b>  | <b>CO1:</b> Understand the energy scenario and the consequent growths of the power generate renewable energy sources.  |      |                |                  |      |      |            |               |            |       |             | K2  |                       |      |      |      |
|  | <b>CO2:</b> Understand the basic of solar power generation   |      |                |                  |      |      |            |               |            |       |             | K2  |                       |      |      |      |
|  | <b>CO3:</b> Understand the basic of wind power generation  |      |                |                  |      |      |            |               |            |       |             | K2  |                       |      |      |      |
|  | <b>CO4:</b> Understand the power electronic interfaces for wind and solar generation.  |      |                |                  |      |      |            |               |            |       |             | K2  |                       |      |      |      |
|  | <b>CO5:</b> Understand the issues related to the grid-integration of solar and wind energy systems.  |      |                |                  |      |      |            |               |            |       |             | K2  |                       |      |      |      |
| <b>Pre-requisites</b>  | U19EE622 - Generation of Electrical Energy   |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 Weak |  |      |                |                  |      |      |            |               |            |       |             |   | <b>CO/PSO Mapping</b> |      |      |      |
| COs  | Programme Outcomes (POs)   |      |                |                  |      |      |            |               |            |       |             |   | PSOs                  |      |      |      |
|  | PO 1   | PO 2 | PO 3           | PO 4             | PO 5 | PO 6 | PO7        | PO8           | PO 9       | PO 10 | PO 11       | PO12  | PSO1                  | PSO2 | PSO3 | PSO4 |
| CO 1   | 2  | 1    | 2              | 2                | -    | -    | 2          | -             | -          | -     | -           | 2   | 2                     | -    | 2    | 1    |
| CO 2   | 2  | 2    | 2              | 2                | 2    | -    | 2          | -             | -          | -     | -           | 2   | 2                     | 1    | 3    | 2    |
| CO 3   | 2  | 2    | 2              | 2                | 2    | -    | 2          | -             | -          | -     | -           | 2   | 2                     | 1    | 3    | 2    |
| CO 4   | 3  | 3    | 2              | 2                | 2    | -    | 2          | -             | -          | -     | -           | 2   | 2                     | 1    | 3    | 2    |
| CO 5   | 2  | 2    | 2              | 2                | 2    | -    | 2          | -             | -          | -     | -           | 2   | 2                     | 1    | 2    | 2    |
| <b>Course Assessment Methods</b>   |  |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |
| <b>Direct</b>  |  |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations       |  |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |
| <b>Indirect</b>  |  |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |
| 1. Course - end survey   |  |      |                |                  |      |      |            |               |            |       |             |   |                       |      |      |      |



| <b>Content of the syllabus</b>   |  |         |           |
|--|--|---------|-----------|
| <b>Unit – I</b>  | <b>GLOBAL AND NATIONAL ENERGY SCENARIO</b>   | Periods | <b>9</b>  |
| Over view of conventional & renewable energy sources, need, potential & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Energy for sustainable development, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems |  |         |           |
| <b>Unit - II</b>   | <b>WIND ENERGY</b>   | Periods | <b>9</b>  |
| Basic Principles of Wind Energy Conversion, Potential, Nature of the wind, Wind Data and Energy Estimation, Site selection, Types of wind turbines, Wind farms, Wind Generation and Control, classification of wind, characteristics, offshore wind energy – Hybrid systems, wind energy potential in India.   |  |         |           |
| <b>Unit – III</b>  | <b>SOLAR ENERGY</b>  | Periods | <b>9</b>  |
| Solar energy system, Solar Radiation - Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Solar Photo Voltaic (SPV) system, Different configurations, SPV system components and their characteristics, Stand-Alone and Grid Connected SPV systems, other Miscellaneous Applications of Solar Energy.  |  |         |           |
| <b>Unit - IV</b>   | <b>POWER ELECTRONIC INTERFACES FOR WIND AND SOLAR GENERATION</b>   | Periods | <b>9</b>  |
| <b>Solar Photovoltaic System</b> – Line Commutated Converters (Inversion Mode), Boost and Buck-Boost Converter, Selection of Inverter, Battery Sizing and Array Sizing.<br><b>Wind System</b> – Three Phase AC Voltage Controllers, AC-DC-AC Converters: Uncontrolled Rectifier, PWM Inverters, Matrix Converters.   |  |         |           |
| <b>Unit – V</b>  | <b>NETWORK INTEGRATION ISSUES</b>  | Periods | <b>9</b>  |
| Overview of grid code technical requirements, Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances, Power quality issues, Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.                      |  |         |           |
| <b>Total Periods</b>   |  |         | <b>45</b> |
| <b>Text Books</b>  |  |         |           |
| 1.   | Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013   |         |           |
| 2.   | Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition., 2009.            |         |           |
| 3.   | G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.  |         |           |
| 4.   | T. Ackermann, Wind Power in Power Systems, John Wiley and Sons Ltd., 2005.   |         |           |
| <b>References</b>  |  |         |           |
| 1.   | Renewable Energy- Edited by Godfrey Boyle-oxford university, press, 3rd edition, 2013.   |         |           |
| 2.   | Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.  |         |           |
| 3.   | Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.  |         |           |
| 4.   | Integrated energy systems modeling--Karlsson, Kenneth Bernard; Skytte, Klaus Morthorst; Published in: DTU International Energy Report 2015 |         |           |
| 5.   | Non conventional energy source –B.H. Khan- TMH-2nd edition.  |         |           |
| <b>E-Resources</b>   |  |         |           |
| 1.   | <a href="http://worldenergy.org">World-Energy-Scenarios Composing-energy-futures-to-2050 Executive-summary.pdf (worldenergy.org)</a>       |         |           |
| 2.   | <a href="http://windows.net">India 2020 - Energy Policy Review (windows.net)</a>   |         |           |
| 3.   | <a href="http://nrel.gov">Solar Energy Basics   NREL</a>   |         |           |
| 4.   | <a href="http://nrel.gov">Wind Energy Basics   NREL</a>  |         |           |
| 5.   | <a href="http://energy.gov">Solar Power Electronic Devices   Department of Energy</a>  |         |           |
| 6.   | <a href="http://nrel.gov">Power Electronics: Roles in Renewable Energy Generation – Challenges and Opportunities (nrel.gov)</a>            |         |           |
| 7.   | <a href="http://greeningthegrid.org">Overview of Grid Integration Issues — Greening the Grid</a>   |         |           |



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| Programme   | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|------------------|------------|------------|-------------|---------------|-----------------|-------|------|------|-------|------|---|-------|------|-------|--|--|--|--|--|--|--|--|--|----------------|--|--|--|-----|--------------------------|--|--|--|--|--|--|--|--|--|--|--|------|--|--|--|------|------|------|------|------|------|-----|-----|------|------|-------|------|------|-------|------|-------|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Course Code   | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   |   | L                | T          | P          | C           | CA            | ESE             | Total |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>U19EEV26</b>   | <b>Advanced Electric Drives</b>   | 3                | 0          | 0          | 3           | 40            | 60              | 100   |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Objectives</b>  | The students should made to <ul style="list-style-type: none"> <li>Acquire the knowledge of selection of drives as per practical operational industrial requirement.</li> <li>Apply their knowledge to prepare control schemes as per different types of motors used in industries</li> <li>Estimate &amp; solve harmonic and power factor related problems in controlling AC and DC drives.</li> </ul> |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |            |            |             |               | Knowledge Level |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | <b>CO1:</b> Understand vector control and direct torque control of induction motor.   |                  |            |            |             |               | K1              |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | <b>CO2:</b> Understand various speed and flux estimation techniques for sensor less vector control of induction motor.  |                  |            |            |             |               | K2              |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | <b>CO3:</b> Understand control strategies of synchronous motor.   |                  |            |            |             |               | K2              |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | <b>CO4:</b> Understand control strategies of reluctance motor.  |                  |            |            |             |               | K1              |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>CO5:</b> Understand control techniques of Permanent Magnet Synchronous Motor (PMSM), Brushless DC Motor (BLDC).  |   |                  |            |            |             | K2            |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Pre-requisites</b>   | U19EE519 - Power Electronics  |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <table border="1"> <thead> <tr> <th colspan="13">CO / PO Mapping<br/>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak</th> <th colspan="4">CO/PSO Mapping</th> </tr> <tr> <th rowspan="2">COs</th> <th colspan="12">Programme Outcomes (POs)</th> <th colspan="4">PSOs</th> </tr> <tr> <th>PO 1</th> <th>PO 2</th> <th>PO 3</th> <th>PO 4</th> <th>PO 5</th> <th>PO 6</th> <th>PO7</th> <th>PO8</th> <th>PO 9</th> <th>PO10</th> <th>PO 11</th> <th>PO12</th> <th>PSO1</th> <th>PSO 2</th> <th>PSO3</th> <th>PSO 4</th> </tr> </thead> <tbody> <tr> <td>CO 1</td> <td>3</td> <td>-</td> <td>1</td> <td>-</td> <td>1</td> <td>-</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>3</td> <td>3</td> <td>3</td> <td>-</td> <td>2</td> <td>3</td> </tr> <tr> <td>CO 2</td> <td>3</td> <td>2</td> <td>-</td> <td>-</td> <td>1</td> <td>-</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>3</td> <td>3</td> <td>3</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>CO 3</td> <td>3</td> <td>-</td> <td>1</td> <td>-</td> <td>2</td> <td>-</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>3</td> <td>3</td> <td>3</td> <td>-</td> <td>2</td> <td>3</td> </tr> <tr> <td>CO 4</td> <td>3</td> <td>2</td> <td>-</td> <td>-</td> <td>3</td> <td>-</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>3</td> <td>3</td> <td>3</td> <td>-</td> <td>2</td> <td>3</td> </tr> <tr> <td>CO 5</td> <td>3</td> <td>-</td> <td>2</td> <td>-</td> <td>3</td> <td>-</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>3</td> <td>3</td> <td>3</td> <td>1</td> <td>2</td> <td>3</td> </tr> </tbody> </table> |   |                  |            |            |             |               |                 |       |      |      |       |      | CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |       |      |       |  |  |  |  |  |  |  |  |  | CO/PSO Mapping |  |  |  | COs | Programme Outcomes (POs) |  |  |  |  |  |  |  |  |  |  |  | PSOs |  |  |  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO8 | PO 9 | PO10 | PO 11 | PO12 | PSO1 | PSO 2 | PSO3 | PSO 4 | CO 1 | 3 | - | 1 | - | 1 | - | 3 | - | - | - | 3 | 3 | 3 | - | 2 | 3 | CO 2 | 3 | 2 | - | - | 1 | - | 3 | - | - | - | 3 | 3 | 3 | 1 | 2 | 3 | CO 3 | 3 | - | 1 | - | 2 | - | 3 | - | - | - | 3 | 3 | 3 | - | 2 | 3 | CO 4 | 3 | 2 | - | - | 3 | - | 3 | - | - | - | 3 | 3 | 3 | - | 2 | 3 | CO 5 | 3 | - | 2 | - | 3 | - | 3 | - | - | - | 3 | 3 | 3 | 1 | 2 | 3 |
| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak   |   |                  |            |            |             |               |                 |       |      |      |       |      | CO/PSO Mapping  |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| COs   | Programme Outcomes (POs)  |                  |            |            |             |               |                 |       |      |      |       |      | PSOs  |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | PO 1  | PO 2             | PO 3       | PO 4       | PO 5        | PO 6          | PO7             | PO8   | PO 9 | PO10 | PO 11 | PO12 | PSO1  | PSO 2 | PSO3 | PSO 4 |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO 1  | 3   | -                | 1          | -          | 1           | -             | 3               | -     | -    | -    | 3     | 3    | 3   | -     | 2    | 3     |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO 2  | 3   | 2                | -          | -          | 1           | -             | 3               | -     | -    | -    | 3     | 3    | 3   | 1     | 2    | 3     |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO 3  | 3   | -                | 1          | -          | 2           | -             | 3               | -     | -    | -    | 3     | 3    | 3   | -     | 2    | 3     |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO 4  | 3   | 2                | -          | -          | 3           | -             | 3               | -     | -    | -    | 3     | 3    | 3   | -     | 2    | 3     |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO 5  | 3   | -                | 2          | -          | 3           | -             | 3               | -     | -    | -    | 3     | 3    | 3   | 1     | 2    | 3     |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Assessment Methods</b>  |   |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Direct</b>   |   |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <ol style="list-style-type: none"> <li>Continuous Assessment Test I, II &amp; III</li> <li>Assignment</li> <li>End-Semester examinations</li> </ol>   |   |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Indirect</b>   |   |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <ol style="list-style-type: none"> <li>Course - end Survey</li> </ol>   |   |                  |            |            |             |               |                 |       |      |      |       |      |   |       |      |       |  |  |  |  |  |  |  |  |  |                |  |  |  |     |                          |  |  |  |  |  |  |  |  |  |  |  |      |  |  |  |      |      |      |      |      |      |     |     |      |      |       |      |      |       |      |       |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>VECTOR CONTROL OF INDUCTION MOTOR</b>  | <b>Periods</b> | <b>9</b>  |
| Principles of vector control, direct vector control, derivation of indirect vector control, implementation-block diagram, estimation of flux, flux weakening operation. DTC principle, operation and control and its comparison with vector control of IM  |   |                |           |
| <b>Unit - II</b>   | <b>SENSOR LESS VECTOR CONTROL OF INDUCTION MOTOR</b>  | <b>Periods</b> | <b>9</b>  |
| Slip and speed estimation at low performance, rotor angle and flux linkage estimation at high performance, rotor speed estimation scheme, estimators using rotor slot harmonics, model reference adaptive systems, extended Kalman filter, injection of auxiliary signal on salient rotor.                 |   |                |           |
| <b>Unit – III</b>  | <b>CONTROL OF SYNCHRONOUS MOTOR DRIVES</b>  | <b>Periods</b> | <b>9</b>  |
| Synchronous motor and its characteristics- Control strategies-Constant torque angle control power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams. Sensor less control and flux observer |   |                |           |
| <b>Unit - IV</b>   | <b>CONTROL OF SWITCHED RELUCTANCE MOTOR DRIVES</b>  | <b>Periods</b> | <b>9</b>  |
| SRM Structure-Stator Excitation-techniques of sensor less operation-converter topologies SRM Waveforms-SRM drive design factors-Torque controlled SRM-Torque Ripple Instantaneous Torque control -using current controllers-flux controllers.  |   |                |           |
| <b>Unit – V</b>  | <b>CONTROL OF BLDC MOTOR DRIVES</b>   | <b>Periods</b> | <b>9</b>  |
| Principle of operation and control of BLDC and PMSM Machine, Sensing and logic switching scheme, These motors as Variable Speed Synchronous motor-methods of reducing Torque pulsations -Three-phase full wave Brushless dc motor - current controlled Brushless dc motor Servo drive.                     |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | R. Krishnan , “Electric Motor Drives Modeling, Analysis & control” Pearson Education, 2003  |                |           |
| 2.   | B. K. Bose “Modern Power Electronics and AC Drives”Pearson Publications,2002  |                |           |
| 3.   | Peter Vas “Sensor less Vector Direct Torque control”, Oxford University Press,2012  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | MD Murphy & FG Turn “Power Electronics control of AC motors”Bull Pergman Press -1st edition,2012  |                |           |
| 2.   | G.K. Dubey “Fundamentals of Electrical Drives”Narosa Publications, 2010.  |                |           |
| 3.   | G.K. Dubey “Power Semiconductor drives ” Prentice hall,2008.  |                |           |
| 4.   | Rik De Doncker, Andre Veltman, Duco WjPulle “Advanced Electrical Drives - Analysis Modeling Control”, 4 <sup>th</sup> Edition 2008          |                |           |
| 5.   | Ned Mohan “Advanced Electric Drives: Analysis, Control, and Modeling”, 5th Edition 2006.  |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://www.digimat.in/nptel/courses/video/108104011/L04.html">https://www.digimat.in/nptel/courses/video/108104011/L04.html</a>   |                |           |
| 2.   | <a href="https://www.youtube.com/playlist?list=PLA5CA7D35114BA425">https://www.youtube.com/playlist?list=PLA5CA7D35114BA425</a>             |                |           |
| 3.   | <a href="https://onlinelibrary.wiley.com/doi/book/10.1002/9781118910962">https://onlinelibrary.wiley.com/doi/book/10.1002/9781118910962</a> |                |           |



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|  |   |                  |            |            |             |               |    |                 |
|--|---|------------------|------------|------------|-------------|---------------|----|-----------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |    |                 |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   |             |               |    |                 |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |    |                 |
|  |   | L                | T          | P          |             | C             | CA | ESE             |
| <b>U19EEV27</b>  | <b>Industrial Electrical Systems</b>  | 3                | 0          | 0          | 3           | 40            | 60 | 100             |
| <b>Course Objective</b>  | The students should made to   |                  |            |            |             |               |    |                 |
|  | <ul style="list-style-type: none"> <li>Learn the basic concepts of electrical equipment's rating calculations and its installation</li> <li>Learn the domestic and industrial electrical illumination systems</li> <li>Learn the basics about industrial power system and storage equipment's</li> <li>Learn the basics of industrial automation</li> </ul> |                  |            |            |             |               |    |                 |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |            |            |             |               |    | Knowledge Level |
|  | <b>CO1:</b> Explain electrical protective and safety devices and its rating calculation   |                  |            |            |             |               |    | K2              |
|  | <b>CO2:</b> Understand the electrical wiring and earthing systems   |                  |            |            |             |               |    | K2              |
|  | <b>CO3:</b> Explain electrical illumination systems and installation procedures   |                  |            |            |             |               |    | K2              |
|  | <b>CO4:</b> Design appropriate electrical power system with protective equipment's industrial applications  |                  |            |            |             |               |    | K2              |
| <b>CO5:</b> Justify the need of industrial automation and components |   |                  |            |            |             |               | K2 |                 |
| <b>Pre-requisites</b>  | Basic concepts electrical engineering   |                  |            |            |             |               |    |                 |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 2                        | -    | 3    | 2    | -    | -    | -    | -    | -    | -     | 1     | -     | 3                     | -     | 3     | 2     |
| CO 2   | 2                        | -    | 3    | 3    | -    | -    | -    | -    | -    | -     | 1     | -     | 3                     | -     | 3     | 2     |
| CO 3   | 2                        | 1    | 3    | 3    | -    | -    | 2    | -    | -    | -     | 1     | 1     | 3                     | -     | 3     | 2     |
| CO 4   | 2                        | -    | 3    | 3    | -    | -    | -    | -    | -    | -     | 2     | -     | 3                     | -     | 3     | 2     |
| CO 5   | 2                        | 1    | 3    | 2    | 3    | -    | 2    | -    | 2    | -     | 2     | 1     | 3                     | 3     | 3     | 2     |

| <b>Course Assessment Methods</b>   |  |
|--|--|
| <b>Direct</b>  |  |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations |  |
| <b>Indirect</b>  |  |
| 1. Course –end Survey  |  |

Signature of the BOS Chairman, EEE

| <b>Content of the syllabus</b>  |  |         |           |
|---|--|---------|-----------|
| <b>Unit – I</b>   | <b>ELECTRICAL SYSTEM COMPONENTS</b>  | Periods | <b>9</b>  |
| LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, Protection components- Fuse, MCB, MCCB, ELCB, Symbols for wiring components, Single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices  |  |         |           |
| <b>Unit - II</b>  | <b>DOMESTIC AND COMMERCIAL ELECTRICAL SYSTEMS</b>  | Periods | <b>9</b>  |
| Types of residential and commercial wiring systems -Guidelines for installation - Load calculation and sizing of wire-Rating of main switch - distribution board and protection devices- Earthing systems - Requirements of commercial installation - lighting schemes – Flood lighting   |  |         |           |
| <b>Unit – III</b>   | <b>ILLUMINATION SYSTEMS</b>  | Periods | <b>9</b>  |
| Various terms - lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor,-various illumination schemes -Modern luminaries like CFL, LED and their operation- Energy saving schemes.   |  |         |           |
| <b>Unit - IV</b>  | <b>ELECTRICAL SYSTEMS IN INDUSTRY</b>  | Periods | <b>9</b>  |
| HT connection, Industrial substation, Transformer selection, Industrial loads, Motors, SLD, Cable and Switchgear selection- Lightning Protection, - Power factor correction – kVAR calculations- Types of compensation -Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components- UPS System - Battery banks -Electrical Systems for the elevators |  |         |           |
| <b>Unit – V</b>   | <b>INDUSTRIAL AUTOMATION</b>   | Periods | <b>9</b>  |
| Basic PLC -Role of automation - Advantages of process automation - PLC based control system design- Panel Metering - SCADA for automation   |  |         |           |
| <b>Total Periods</b>  |  |         | <b>45</b> |
| <b>Text Books</b>   |  |         |           |
| 1.  | J.B. Gupta, “Utilization of Electric Power and Electric Traction”, Kataria& Sons publishers, Delhi, IX Edition, 2004.  |         |           |
| 2.  | S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.  |         |           |
| <b>References</b>   |  |         |           |
| 1.  | K. B. Raina, “Electrical Design, Estimating& Costing”, New Age International, 2007.  |         |           |
| 2.  | N.V. Suryanarayana, “Utilization of Electrical Power including Electric drives and Electric Traction”, New Age International (P) Limited Publishers, 2014.                               |         |           |
| 3.  | S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 2017.  |         |           |
| 4.  | H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2018   |         |           |
| <b>Resources</b>  |  |         |           |
| 1.  | <a href="https://nptel.ac.in/courses">ps://nptel.ac.in/courses</a>   |         |           |
| 2.  | <a href="https://www.electrical4u.com/electrical-engineering-articles/illumination-engineering/">ps://www.electrical4u.com/electrical-engineering-articles/illumination-engineering/</a> |         |           |
| 3.  | Standards : <a href="https://bis.gov.in">https://bis.gov.in</a>  |         |           |





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|   |  |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
|---|--|------------------|------------|------------|-------------|---------------|-----|-----------------|------|-------|-------|------|-----------------------|------|-------|------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |     |                 |      |       |       |      |                       |      |       |      |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |     |                 |      |       |       |      |                       |      |       |      |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |     |                 |      |       |       |      |                       |      |       |      |
|   |  | L                | T          | P          | C           | CA            | ESE | Total           |      |       |       |      |                       |      |       |      |
| <b>U19EEV28</b>   | <b>Power Switching Converters</b>  | 3                | 0          | 0          | 3           | 40            | 60  | 100             |      |       |       |      |                       |      |       |      |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Understand the soft switching concepts of power converters</li> <li>• Impart required skills to analyze the Switched Mode Power Supplies.</li> <li>• Familiarize and the switching sequence of Power conversion.</li> </ul> |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               |     | Knowledge Level |      |       |       |      |                       |      |       |      |
|   | <b>CO1:</b> Understand resonant converter systems.   |                  |            |            |             |               |     | K2              |      |       |       |      |                       |      |       |      |
|   | <b>CO2:</b> Understand the switched mode supplies.   |                  |            |            |             |               |     | K2              |      |       |       |      |                       |      |       |      |
|   | <b>CO3:</b> Analyze and understand to achieve the improvement of efficiency in AC- DC conversion   |                  |            |            |             |               |     | K4              |      |       |       |      |                       |      |       |      |
|   | <b>CO4:</b> Design and simulate modern inverters for various generic load and drives.  |                  |            |            |             |               |     | K4              |      |       |       |      |                       |      |       |      |
| <b>CO5:</b> Select device and calculate performance parameters of multi form conversion under various operating modes |  |                  |            |            |             |               | K4  |                 |      |       |       |      |                       |      |       |      |
| <b>Pre-requisites</b>   | Power Electronics, Control Systems   |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak                    |  |                  |            |            |             |               |     |                 |      |       |       |      | <b>CO/PSO Mapping</b> |      |       |      |
| <b>Cos</b>  | Programme Outcomes (Pos)   |                  |            |            |             |               |     |                 |      |       |       |      | PSOs                  |      |       |      |
|   | PO 1   | PO 2             | PO 3       | PO 4       | PO 5        | PO 6          | PO7 | PO8             | PO 9 | PO 10 | PO 11 | PO12 | PSO1                  | PSO2 | PSO 3 | PSO4 |
| CO 1  | 3  | 3                | 2          | 1          | 1           | 1             | 1   | 2               | 0    | 1     | 0     | 1    | 3                     | 2    | 2     | 2    |
| CO 2  | 2  | 1                | 2          | 2          | 1           | 2             | 2   | 3               | 1    | 1     | 1     | 2    | 2                     | 2    | 1     | 1    |
| CO 3  | 2  | 2                | 1          | 1          | 3           | 1             | 1   | 2               | 1    | 1     | 2     | 1    | 1                     | 1    | 1     | 2    |
| CO 4  | 2  | 1                | 1          | 2          | 1           | 1             | 1   | 1               | 2    | 1     | 1     | 1    | 1                     | 2    | 2     | 1    |
| CO 5  | 3  | 2                | 2          | 1          | 1           | 1             | 2   | 2               | 1    | 1     | 1     | 1    | 2                     | 2    | 1     | 1    |
| <b>Course Assessment Methods</b>  |  |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
| <b>Direct</b>   |  |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations                            |  |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
| <b>Indirect</b>   |  |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |
| 1.Course – end survey   |  |                  |            |            |             |               |     |                 |      |       |       |      |                       |      |       |      |

| <b>Content of the Syllabus</b>   |   |         |           |
|--|---|---------|-----------|
| <b>Unit – I</b>  | <b>Soft Switching Converters</b>  | Periods | <b>9</b>  |
| Switching loss, basic principles of hard and soft switching. Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter   |   |         |           |
| <b>Unit – II</b>   | <b>Switched Mode Power Supplies</b>   | Periods | <b>9</b>  |
| DC Power supplies and Classification; Switched mode DC power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation.   |   |         |           |
| <b>Unit – III</b>  | <b>AC-DC Converters</b>   | Periods | <b>9</b>  |
| Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor. reduced input current harmonic distortion improved efficiency with and without input-output isolation.   |   |         |           |
| <b>Unit – IV</b>   | <b>DC- AC Converters</b>  | Periods | <b>9</b>  |
| Multilevel concept – diode clamped – flying capacitor – cascaded type multilevel inverters - Comparison of multilevel inverters - application of multilevel inverters – PWM techniques for MLI – Single phase &Three phase Impedance source inverters – Filters.   |   |         |           |
| <b>Unit – V</b>  | <b>AC-AC Converters with and without DC Link</b>  | Periods | <b>9</b>  |
| Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters. |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
| 1  | Rashid M.H., “Power Electronics Circuits, Devices and Applications ”, Pearson, fourth Edition, 10th Impression 2021 |         |           |
| 2  | Jai P. Agrawal, “Power Electronics System Theory and Design”, Pearson Education, First Edition, 2015.               |         |           |
| 3  | Bimal.K.Bose “Modern Power Electronics and AC Drives”, Pearson Education, Second Edition, 2003                      |         |           |
| 4  | P.S.Bimbra, “Power Electronics”, Khanna Publishers, Eleventh Edition, 2003  |         |           |
| <b>References</b>  |   |         |           |
| 1  | Philip T. Krein, “Elements of Power Electronics” Indian edition Oxford University Press-2017                        |         |           |
| 2  | Bin Wu, Mehdi Narimani, "High-Power Converters and AC Drives", Wiley, 2nd Edition, 2017.                            |         |           |
| 3  | M. K. Kazimierczuk and D. Czarkowski, “Resonant Power Converters”, 2nd Edition, Wiley 2011.                         |         |           |
| 4  | M Singh, K Khanchandani, “Power Electronics”, McGraw hill Education, Second edition, 2017.                          |         |           |
| 5  | Muhammad H. Rashid, Power Electronics   Devices, Circuits and Applications, Fourth Edition, Pearson 2017.           |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1  | <a href="https://1lib.in/book/3555381/8d9744">https://1lib.in/book/3555381/8d9744</a>                               |         |           |
| 2  | <a href="https://1lib.in/book/2712535/4ccc78">https://1lib.in/book/2712535/4ccc78</a>                               |         |           |
| 3  | <a href="https://nptel.ac.in/courses/108105066">https://nptel.ac.in/courses/108105066</a>                           |         |           |

|  |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
|--|--|----------------|------------------|------|------|----------|------------|---------------|------------|-------|---|-------|-----------------------|-------|-------|-------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                |                  |      |      |          |            |               |            |       |  |       |                       |       |       |       |
| Programme  | <b>B.E.</b>  | Programme Code |                  |      |      |          | <b>102</b> |               | Regulation |       | <b>2019</b>   |       |                       |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                |                  |      |      | Semester |            |               |            |       |   |       |                       |       |       |       |
| Course Code  | Course Name  |                | Periods Per Week |      |      | Credit   |            | Maximum Marks |            |       |   |       |                       |       |       |       |
|  |  |                | L                | T    | P    | C        | CA         | ESE           | Total      |       |   |       |                       |       |       |       |
| <b>U19EEV31</b>  | <b>Communication Engineering</b>   |                | 3                | 0    | 0    | 3        | 40         | 60            | 100        |       |   |       |                       |       |       |       |
| <b>Course Objectives</b>   | The students should be   |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
|  | <ul style="list-style-type: none"> <li>• To acquire knowledge on various analog and digital modulation techniques</li> <li>• To study the principles behind information theory and coding</li> <li>• To learn various digital communication techniques</li> <li>• To gain knowledge in radio communication techniques</li> </ul> |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                |                  |      |      |          |            |               |            |       | Knowledge Level   |       |                       |       |       |       |
|  | <b>CO1:</b> Apply analog and digital communication techniques.   |                |                  |      |      |          |            |               |            |       | <b>K3</b>   |       |                       |       |       |       |
|  | <b>CO2:</b> Use data and pulse communication techniques.   |                |                  |      |      |          |            |               |            |       | <b>K2</b>   |       |                       |       |       |       |
|  | <b>CO3:</b> Analyze Source and Error control coding.   |                |                  |      |      |          |            |               |            |       | <b>K3</b>   |       |                       |       |       |       |
|  | <b>CO4:</b> Utilize multiuser radio communication techniques.  |                |                  |      |      |          |            |               |            |       | <b>K1</b>   |       |                       |       |       |       |
| <b>Pre-requisites</b>  |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                |                  |      |      |          |            |               |            |       |   |       | <b>CO/PSO Mapping</b> |       |       |       |
| <b>COs</b>   | <b>Programme Outcomes (POs)</b>  |                |                  |      |      |          |            |               |            |       |   |       | <b>PSOs</b>           |       |       |       |
|  | PO 1   | PO 2           | PO 3             | PO 4 | PO 5 | PO 6     | PO 7       | PO 8          | PO 9       | PO 10 | PO 11   | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3  |                |                  |      |      |          | 3          |               |            |       | 3   | 3     | 3                     |       |       | 3     |
| CO 2   | 3  |                |                  |      |      |          | 3          |               |            |       | 3   | 3     | 3                     |       |       | 3     |
| CO 3   | 3  |                |                  |      |      |          | 3          |               |            |       | 3   | 3     | 3                     |       |       | 3     |
| CO 4   | 3  |                |                  |      |      |          | 3          |               |            |       | 3   | 3     | 3                     |       |       | 3     |
| CO 5   | 3  |                |                  |      |      |          | 3          |               |            |       | 3   | 3     | 3                     |       |       | 3     |
| <b>Course Assessment Methods</b>   |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| <b>Direct</b>  |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| 1. Continuous Assessment Test I, II & III  |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| 2. Assignment  |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| 3. End-Semester examinations   |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| <b>Indirect</b>  |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |
| 1. Course – end Survey   |  |                |                  |      |      |          |            |               |            |       |   |       |                       |       |       |       |



| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>ANALOG MODULATION</b>  | <b>Periods</b> | <b>9</b>  |
| Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Super heterodyne receivers  |   |                |           |
| <b>Unit - II</b>  | <b>PULSE MODULATION</b>   | <b>Periods</b> | <b>9</b>  |
| Sampling Process, PAM, PWM, PPM, Quantization – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing   |   |                |           |
| <b>Unit – III</b>   | <b>DIGITAL MODULATION AND TRANSMISSION</b>  | <b>Periods</b> | <b>9</b>  |
| Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers  |   |                |           |
| <b>Unit - IV</b>  | <b>INFORMATION THEORY AND CODING</b>  | <b>Periods</b> | <b>9</b>  |
| Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding       |   |                |           |
| <b>Unit – V</b>   | <b>SPREAD SPECTRUM AND MODERN COMMUNICATION SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Spread Spectrum: PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronization and tracking.<br>Modern Communication Systems: GSM – Cellular concept Frequency Reuse, Channel assignment and handover techniques – Overview of Multiple Access schemes. |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 3/e, TMH 2007                                |                |           |
| 2.  | S. Haykin “Digital Communications” John Wiley 2005.   |                |           |
| 3.  | Wayne Tomasi, “Advanced Electronic Communication Systems”, 6 <sup>th</sup> Edition, Pearson Education, 2009       |                |           |
| <b>References</b>   |   |                |           |
| 1.  | B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007          |                |           |
| 2.  | H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006                                     |                |           |
| 3.  | B.Sklar, “Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007.                       |                |           |
| 4.  | Rappaport T.S, “Wireless Communication Principles and Practice”, 2 <sup>nd</sup> Edition, Pearson Education, 2007 |                |           |
| 5.  | Taub and Schilling “Principles of Communication systems” – TMH, 4 <sup>th</sup> Edition                           |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses/117/105/117105143/">https://nptel.ac.in/courses/117/105/117105143/</a>       |                |           |
| 2.  | <a href="https://nptel.ac.in/courses/108/102/108102117/">https://nptel.ac.in/courses/108/102/108102117/</a>       |                |           |



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|                          |  |                  |            |            |             |               |                 |     |
|--------------------------|--|------------------|------------|------------|-------------|---------------|-----------------|-----|
| Programme                | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                 |     |
| Department               | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |                 |     |
| Course Code              | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |                 |     |
|                          |  | L                | T          | P          |             | C             | CA              | ESE |
| <b>U19EEV32</b>          | <b>Computer Architecture</b>   | 3                | 0          | 0          | 3           | 40            | 60              | 100 |
| <b>Course Objectives</b> | The students should be made to <ul style="list-style-type: none"> <li>To make students understand the basic structure and operation of digital computer</li> <li>To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations</li> <li>To expose the students to the concept of pipelining</li> </ul> |                  |            |            |             |               |                 |     |
| <b>Course Outcome</b>    | At the end of the course, the student should be able to,   |                  |            |            |             |               | Knowledge Level |     |
|                          | <b>CO1:</b> Design arithmetic and logic unit.  |                  |            |            |             |               | K3              |     |
|                          | <b>CO2:</b> Design and analyze pipelined control units Evaluate performance of memory systems.   |                  |            |            |             |               | K3              |     |
|                          | <b>CO3:</b> Understand fixed point and floating-point arithmetic operations  |                  |            |            |             |               | K3              |     |
|                          | <b>CO4:</b> Understand the hardware-software interface   |                  |            |            |             |               | K2              |     |
| <b>Pre-requisites</b>    | <b>CO5:</b> Understand Hierarchical memory system including cache memories and virtual memory  |                  |            |            |             |               | K2              |     |
|                          |  |                  |            |            |             |               |                 |     |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 1                        |      |      | 1    |      |      | 2    |      |      | 1     | 3     | 1     | 1              |       | 1     | 1     |
| CO 2  | 1                        | 2    | 1    |      |      | 1    |      | 1    | 1    |       |       | 1     |                | 1     | 1     | 1     |
| CO 3  | 1                        |      | 1    |      | 1    | 2    |      | 1    | 2    |       |       | 1     | 1              |       |       | 2     |
| CO 4  | 1                        |      | 2    |      |      | 2    |      | 3    | 1    | 3     | 2     | 1     | 1              |       |       | 2     |
| CO 5  | 1                        |      |      |      | 1    | 2    |      | 2    | 2    |       |       | 1     | 1              |       |       | 1     |

**Course Assessment Methods**

|   |
|---|
| <b>Direct</b>                             |
| 1. Continuous Assessment Test I, II & III |
| 2. Assignment                             |
| 3. End-Semester examinations              |
| <b>Indirect</b>                           |
| 1. Course – end Survey                    |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>OVERVIEW &amp; INSTRUCTIONS</b>  | <b>Periods</b> | <b>9</b>  |
| Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.. |   |                |           |
| <b>Unit - II</b>   | <b>ARITHMETIC OPERATIONS</b>  | <b>Periods</b> | <b>9</b>  |
| ALU – Addition and subtraction – Multiplication – Division – Floating Point operations – Sub word parallelism  |   |                |           |
| <b>Unit – III</b>  | <b>PROCESSOR AND CONTROL UNIT</b>   | <b>Periods</b> | <b>9</b>  |
| Basic MIPS implementation – Building data path – Control Implementation scheme – Pipelining – Pipelined Data path and control – Handling Data hazards & Control hazards – Exceptions   |   |                |           |
| <b>Unit - IV</b>   | <b>PARALLELISM</b>  | <b>Periods</b> | <b>9</b>  |
| Instruction-level-parallelism – Parallel processing challenges – Flynn’s classification – Hardware multithreading – Multi core processors.-clustering-GPU.   |   |                |           |
| <b>Unit – V</b>  | <b>MEMORY AND I/O SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Memory hierarchy – Memory technologies – Cache basics – Measuring and improving cache performance – Virtual memory, TLBs – Input/output system, programmed I/O, DMA and interrupts, I/O processors.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | David A. Patterson and John L. Hennessey, “Computer Organization and Design“, Fifth edition, Morgan Kauffman / Elsevier, 2014.. |                |           |
| 2.   | William Stallings “Computer Organization and Architecture” Seventh Edition, PHI/Pearson, 2006                                   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | V.CarlHamacher, Zvonko G. Varanescic and Safat G. Zaky, “Computer Organisation“, VI edition, Mc Graw-Hill Inc, 2012.            |                |           |
| 2.   | William Stallings “Computer Organization and Architecture”, Seventh Edition , Pearson Education, 2009.                          |                |           |
| 3.   | Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, Second Edition, Pearson Education, 2005.                   |                |           |
| 4.   | M.Moris Mano“Computer System Architecture”, 3rd Edition, PHI / Pearson, 2006.   |                |           |
| 5.   | John P. Hayes“Computer Architecture and Organization”, Mc Graw Hill International editions, 1998.                               |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/106/106/106106134/">https://nptel.ac.in/courses/106/106/106106134/</a>                     |                |           |
| 2.   | <a href="https://www.tutorialspoint.com/control-unit-and-cpu">https://www.tutorialspoint.com/control-unit-and-cpu</a>           |                |           |



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|  |  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
|--|--|------------------|------|------|----------|---------------|------------|-----------------|------|-------|-------|-----------------------|------|------|------|------|
| Programme  | <b>B.E.</b>  | Programme Code   |      |      |          | <b>102</b>    | Regulation | <b>2019</b>     |      |       |       |                       |      |      |      |      |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |      |      | Semester |               |            |                 |      |       |       |                       |      |      |      |      |
| Course Code  | Course Name  | Periods Per Week |      |      | Credit   | Maximum Marks |            |                 |      |       |       |                       |      |      |      |      |
|  |  | L                | T    | P    | C        | CA            | ESE        | Total           |      |       |       |                       |      |      |      |      |
| <b>U19EEV33</b>  | <b>Intelligent techniques</b>  | 3                | 0    | 0    | 3        | 40            | 60         | 100             |      |       |       |                       |      |      |      |      |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>Understand the fundamental concepts and characteristics and methodologies of intelligent systems.</li> <li>Understand the power and usefulness of intelligent techniques</li> <li>Know the design of artificial intelligence systems, evolutionary computation algorithms, uncertainty representation and reasoning mechanisms</li> </ul> |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |      |      |          |               |            | Knowledge Level |      |       |       |                       |      |      |      |      |
|  | <b>CO1:</b> Understand fundamental concepts and characteristics of Intelligent systems   |                  |      |      |          |               |            | K1              |      |       |       |                       |      |      |      |      |
|  | <b>CO2:</b> Understand the concepts in Fuzzy logic system  |                  |      |      |          |               |            | K1              |      |       |       |                       |      |      |      |      |
|  | <b>CO3:</b> Analyze and understand artificial intelligence systems   |                  |      |      |          |               |            | K1              |      |       |       |                       |      |      |      |      |
|  | <b>CO4:</b> Analyze the intelligent system approaches in real-life electrical engineering problems   |                  |      |      |          |               |            | K3              |      |       |       |                       |      |      |      |      |
| <b>CO5:</b> Apply the Intelligent systems in real-time applications                                |  |                  |      |      |          |               | K2         |                 |      |       |       |                       |      |      |      |      |
| <b>Pre-requisites</b>  | Control Systems  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |  |                  |      |      |          |               |            |                 |      |       |       | <b>CO/PSO Mapping</b> |      |      |      |      |
| <b>Cos</b>   | Programme Outcomes (Pos)   |                  |      |      |          |               |            |                 |      |       |       |                       | PSOs |      |      |      |
|  | PO 1   | PO 2             | PO 3 | PO 4 | PO 5     | PO 6          | PO7        | PO8             | PO 9 | PO 10 | PO 11 | PO12                  | PSO1 | PSO2 | PSO3 | PSO4 |
| <b>CO 1</b>  | 2  | 2                | 2    | 1    | 1        | 1             | 1          | 2               | -    | 1     | -     | 1                     | 2    | 2    | 2    | 2    |
| <b>CO 2</b>  | 2  | 1                | 2    | 2    | 1        | 1             | 2          | 3               | 1    | 1     | 1     | 2                     | 2    | 2    | 1    | 1    |
| <b>CO 3</b>  | 2  | 2                | 1    | 1    | 2        | 1             | 1          | 2               | 1    | 1     | 2     | 1                     | 1    | 1    | 1    | 2    |
| <b>CO 4</b>  | 2  | 1                | 1    | 2    | 1        | 1             | 1          | 1               | 2    | 1     | 1     | 1                     | 1    | 2    | 2    | 1    |
| <b>CO 5</b>  | 2  | 2                | 2    | 1    | 1        | 1             | 2          | 2               | 1    | 1     | 1     | 1                     | 2    | 2    | 1    | 1    |
| <b>Course Assessment Methods</b>   |  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
| <b>Direct</b>  |  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
| 1.Continuous Assessment Test I, II &III<br>2.Assignment<br>3.End-Semester examinations             |  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
| <b>Indirect</b>  |  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |
| 1. Course – end survey   |  |                  |      |      |          |               |            |                 |      |       |       |                       |      |      |      |      |

| <b>Content of the syllabus</b>   |   |         |           |
|--|---|---------|-----------|
| <b>Unit – I</b>  | <b>Knowledge-based intelligent systems</b>  | Periods | <b>9</b>  |
| Concepts and theory. Knowledge representation techniques. Structure of a rule-based expert system. Forward and backward chaining inference techniques.   |   |         |           |
| <b>Unit – II</b>   | <b>Fuzzy systems</b>  | Periods | <b>9</b>  |
| Concepts of Fuzzy reasoning. Membership Functions and Fuzzy sets. Fuzzy rules. Defuzzification methods. Fuzzy inference. Building a fuzzy expert system. |   |         |           |
| <b>Unit – III</b>  | <b>Artificial neural networks (ANN)</b>   | Periods | <b>9</b>  |
| Concepts of ANN. Neuron and perception. Multilayer neural networks. Forward and Backward Propagation. Neural Network Training. Hopfield network.         |   |         |           |
| <b>Unit – IV</b>   | <b>Evolutionary computation</b>   | Periods | <b>9</b>  |
| Concepts of Evolutionary computing. Genetic unit algorithms. Chromosomes, fitness function, cross-over and mutation. Evolutionary Programming.           |   |         |           |
| <b>Unit – V</b>  | <b>Applications of intelligent systems</b>  | Periods | <b>9</b>  |
| Applications in Control and Utilization – Intelligent process control. -DC/AC four quadrant drive control - Intelligent robot control and Utilization.   |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
| 1  | Lin, C., Lee, G., Neural Fuzzy Systems, Prentice Hall International Inc. 2000.  |         |           |
| 2  | Rajashekran, S. and Vijaylaksmi Pai, G.A., Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications, Prentice Hall of India Private Limited, 2004.                     |         |           |
| 3  | Zurda, J.M., C++ Neural Networks and Fuzzy Logics, BPS Publication 2001.  |         |           |
| <b>References</b>  |   |         |           |
| 1  | K.Y. Lee and M.A. El-Sharkawi, Modern Heuristic Optimization Techniques: Theory and Applications to Power Systems, Wiley-IEEE Press, 2008   |         |           |
| 2  | M.Negnevitsky, Artificial Intelligence-A Guide to Intelligent Systems, AddisonWesley, 2011  |         |           |
| 3  | Munersj Staffan, Intelligent computer systems in engineering design, SpringerLink ebooks, Springer, 2016  |         |           |
| 4  | Handbook of research on advanced hybrid intelligent techniques and applications, InfoSci-Books, Hershey, PA: Information Science Reference 2016   |         |           |
| 5  | Subhojit Dawn, Valentina Emilia Balas Anna Esposito Sadan Gope Editors., Intelligent Techniques and Applications in Science and Technology, Springer 2020.                                  |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1  | <a href="https://qsstudy.com/benefits-of-using-intelligent-techniques-for-knowledge-management/">https://qsstudy.com/benefits-of-using-intelligent-techniques-for-knowledge-management/</a> |         |           |
| 2  | <a href="https://www.javatpoint.com/artificial-neural-network">https://www.javatpoint.com/artificial-neural-network</a>   |         |           |
| 3  | <a href="https://www.techtarget.com/whatis/definition/intelligent-system">https://www.techtarget.com/whatis/definition/intelligent-system</a>   |         |           |



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|  |   |                  |            |            |             |               |    |                        |
|--|---|------------------|------------|------------|-------------|---------------|----|------------------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |    |                        |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   |             |               |    |                        |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |    |                        |
|  |   | L                | T          | P          |             | C             | CA | ESE                    |
| <b>U19EEV34</b>  | <b>Bio Medical Instrumentation</b>  | 3                | 0          | 0          | 3           | 40            | 60 | 100                    |
| <b>Course Objective</b>                                  | The students should made to <ul style="list-style-type: none"> <li>• To Introduce Fundamentals of Biomedical Engineering</li> <li>• To study measurement of certain important electrical and non-electrical parameters</li> <li>• To understand the basic principles in imaging techniques</li> <li>• To have a basic knowledge in life assisting and the rapeutic devices</li> </ul> |                  |            |            |             |               |    |                        |
| <b>Course Outcome</b>                                    | At the end of the course, the student should be able to,  |                  |            |            |             |               |    | <b>Knowledge Level</b> |
|  | <b>CO1:</b> Interpret the basic principles and phenomena of bio medical engineering   |                  |            |            |             |               |    | K2                     |
|  | <b>CO2:</b> Measure bio medical signal parameters through medical instruments.  |                  |            |            |             |               |    | K3                     |
|  | <b>CO3:</b> Record the bio electric potentials using bio potential electrode through bio signal recording devices.  |                  |            |            |             |               |    | K3                     |
|  | <b>CO4:</b> Summarize the basic principles in medical imaging techniques.   |                  |            |            |             |               |    | K2                     |
| <b>CO5:</b> Illustrate the physiological assist devices. |   |                  |            |            |             |               | K3 |                        |
| <b>Pre-requisites</b>                                    | -   |                  |            |            |             |               |    |                        |

| <b>CO / POMapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       | <b>CO/PSO Mapping</b> |       |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-----------------------|-------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |                       | PSOs  |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12                 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3                        | 1    |      |      |      | 2    |      | 1    |      |       |       |                       | 2     |       | 2     |       |
| CO 2  | 3                        | 2    | 1    | 1    | 1    | 2    |      | 1    |      |       |       |                       | 1     |       | 2     |       |
| CO 3  | 3                        | 2    | 1    | 1    | 1    | 2    |      | 1    |      |       |       |                       | 2     |       | 1     |       |
| CO 4  | 3                        | 1    |      |      |      | 2    |      | 1    |      |       |       |                       | 2     |       | 2     |       |
| CO 5  | 3                        | 2    | 1    | 1    | 1    | 2    |      | 1    |      |       |       |                       | 3     |       | 3     |       |

**Course Assessment Methods**

|                 |  |
|-----------------|--|
| <b>Direct</b>   |  |
| 1               | Continuous Assessment Test I, II & III |
| 2               | Assignment                             |
| 3               | End-Semester examinations              |
| <b>Indirect</b> |  |
| 1.              | Course – end Survey                    |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>HUMAN PHYSIOLOGICAL SYSTEMS</b>  | <b>Periods</b> | <b>9</b>  |
| Cell and its structure – Resting and Action Potential – skeletal system - circulatory system - Nervous system and its fundamentals – Cardiovascular systems- Respiratory systems –Components of bio medical system - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezoelectric, ultrasonic transducers - Temperature measurements - Fiber optic temperature sensors. |   |                |           |
| <b>Unit - II</b>   | <b>BIO MEDICAL NON ELECTRICAL SIGNAL MEASUREMENT</b>  | <b>Periods</b> | <b>9</b>  |
| Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analyzers, pH of blood – measurement of blood pCO <sub>2</sub> , pO <sub>2</sub> , finger-tip oximeter - ESR, GSR measurements.   |   |                |           |
| <b>Unit – III</b>  | <b>BIO MEDICAL ELECTRICAL SIGNAL MEASUREMENT</b>  | <b>Periods</b> | <b>9</b>  |
| Electrodes – Limb electrodes –floating electrodes –disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers –Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment's.                               |   |                |           |
| <b>Unit - IV</b>   | <b>BIO MEDICAL IMAGING SYSTEMS</b>  | <b>Periods</b> | <b>9</b>  |
| Radio graphic and fluoroscopic techniques - X-ray machine – Computer tomography – MRI – Ultrasonography– Endoscopy–Thermography–Different types of biotelemetry systems-Retinal Imaging– Imaging application in Biometric systems .  |   |                |           |
| <b>Unit – V</b>  | <b>LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES</b>  | <b>Periods</b> | <b>9</b>  |
| Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers – Lithotripsy - ICU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice hall of India, New Delhi, 2007.   |                |           |
| 2.   | Joseph J.carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and sons, New York, 4th Edition, 2012.                             |                |           |
| 3.   | Khandpur R.S, “Handbook of Biomedical Instrumentation”, , Tata McGraw-Hill, New Delhi, 3rd Edition, 2014.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 1998.   |                |           |
| 2.   | Duane Knudson, “Fundamentals of Biomechanics”, Springer, 2nd Edition, 2007.   |                |           |
| 3.   | Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.                                    |                |           |
| 4.   | Andrew G.Webb, “Principles of bio medical instrumentation”1 <sup>st</sup> Edition, Cambridge University Press, United Kingdom, 2018.                              |                |           |
| 5.   | Arumugam M., “Bio Medical Instrumentation”, 2 <sup>nd</sup> Edition, Anuradha Agencies, Kumbakonam, 2017.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/109/104/109104029/">https://nptel.ac.in/courses/109/104/109104029/</a>   |                |           |
| 2.   | <a href="http://biomedikal.in/2009/12/lecture-notes-on-biomedical-instrumentation/">http://biomedikal.in/2009/12/lecture-notes-on-biomedical-instrumentation/</a> |                |           |
| 3.   | <a href="https://nptel.ac.in/courses/108/105/108105091/">https://nptel.ac.in/courses/108/105/108105091/</a>   |                |           |
|  |   |                |           |



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|--|--|------------------|-------------|-------------|-------------|---------------|-------------|------------------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
| Programme  | <b>B.E.</b>  | Programme Code   | <b>102</b>  | Regulation  | <b>2019</b> |               |             |                        |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             | Semester    |             |               |             |                        |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit      | Maximum Marks |             |                        |             |              |              |                       |              |              |              |              |
|  |  | L                | T           | P           |             | C             | CA          | ESE                    | Total       |              |              |                       |              |              |              |              |
| <b>U19EEV35</b>  | <b>Robotics And Control</b>  | 3                | 0           | 0           | 3           | 40            | 60          | 100                    |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>• Study the various components of robots</li> <li>• Understand the advantages and limitations of robots</li> <li>• Design their own robot as their final project</li> </ul> |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |             |             |             |               |             | <b>Knowledge Level</b> |             |              |              |                       |              |              |              |              |
|  | <b>CO1:</b> Introduces students to the basic principles of robotics, engineering design and computer science. The topics will cover fundamental topics related to engineering processes, design, computer science and robotics.                |                  |             |             |             |               |             | K1                     |             |              |              |                       |              |              |              |              |
|  | <b>CO2:</b> Be selective on sensors and plan accurate control end effectors movements.   |                  |             |             |             |               |             | K1                     |             |              |              |                       |              |              |              |              |
|  | <b>CO3:</b> The topics will help students understand the techniques used to design robots that perform different tasks, their limitations and advantages.  |                  |             |             |             |               |             | K3                     |             |              |              |                       |              |              |              |              |
|  | <b>CO4:</b> Reevaluate their robotic designs using the new concepts studied  |                  |             |             |             |               |             | K5                     |             |              |              |                       |              |              |              |              |
| <b>CO5:</b> Program the robot to capture high resolution images for operations |  |                  |             |             |             |               | K4          |                        |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  | Basic concepts of Electric Circuits, Sensors and Control Engineering   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b>   |  |                  |             |             |             |               |             |                        |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak       |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |             |             |             |               |             |                        |             |              |              |                       | PSOs         |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 2                |             |             |             |               |             |                        |             |              |              | 2                     | 3            |              | 2            |              |
| <b>CO 2</b>  | 3  | 3                | 2           |             |             |               |             |                        |             |              |              | 2                     | 3            | 2            | 2            |              |
| <b>CO 3</b>  | 3  | 3                | 2           |             |             |               |             |                        |             |              |              | 2                     | 3            | 2            | 3            |              |
| <b>CO 4</b>  | 3  | 2                |             |             |             |               |             |                        |             |              |              | 2                     | 3            |              | 2            |              |
| <b>CO 5</b>  | 3  | 2                |             | 2           |             |               |             |                        |             |              |              | 2                     | 3            |              | 2            |              |
| <b>Course Assessment Methods</b>   |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| 1. Continuous Assessment Test I, II &III                                       |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| 2. Assignment  |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| 3. End-Semester Examinations   |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| 1 Course – end Survey  |  |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |



| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>BASICS OF ROBOTICS</b>   | <b>Periods</b> | <b>9</b>  |
| Brief history – Types of robots – Classification of Robots – Robot Components – Degrees of freedom – Asimov’s laws of robotics – work cell – Robot Workspace – Joints, Coordinates and Reference frames – Robot Characteristics   |   |                |           |
| <b>Unit - II</b>  | <b>ROBOT MECHANICS</b>  | <b>Periods</b> | <b>9</b>  |
| Power and torque – Acceleration and velocity – Design models for ground mobile robots – Design models for mechanic arms and lifting systems – Fundamentals of kinematics.   |   |                |           |
| <b>Unit – III</b>   | <b>ROBOT DRIVE SYSTEMS AND END EFFECTORS</b>  | <b>Periods</b> | <b>9</b>  |
| Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives – Servo motors – DC and AC Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingereed and Three Fingereed Grippers; Internal Grippers and External Grippers; Selection and Design Considerations |   |                |           |
| <b>Unit - IV</b>  | <b>SENSORS, CONTROL AND KINEMATICS</b>  | <b>Periods</b> | <b>9</b>  |
| Requirements of a sensor, Position sensors – Resolvers, Optical Encoders, Lighting Approach, Range Finders, Laser Range Meters, Analog Sensors, Sensing distance and direction – Line Following Algorithms – Feedback Systems – Direct and inverse Kinematics – Hill Climbing techniques  |   |                |           |
| <b>Unit – V</b>   | <b>MACHINE VISION</b>   | <b>Periods</b> | <b>9</b>  |
| Camera, Frame Grabber, Sensing and Digitizing Image Data– Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis– Two- and Three- Dimensional Image Types– Applications– Inspection, Identification, Visual Serving and Navigation.   |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | Saeed Benjamin Niku, “Introduction To Robotics Analysis, Control, Applications, Second Edition John Wiley & Sons. 2011  |                |           |
| 2.  | R Mittle, I Nagrath, “Robotics and Control”, McGraw Hill Education ,July 2017.  |                |           |
| 3.  | John J. Craig, “Introduction to Robotics Mechanics and Control”, Second Edition, Addison Wesley Longman Inc. International Student edition, 1999.   |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Robotics: Fundamental Concepts and Analysis by Ashitava Ghosal, Oxford University Press, 2006.  |                |           |
| 2.  | Robert Towers, Larry Ross, Stephen Fardo, James Masterson,” Robotics Technology: Theory and Industrial Applications”2nd edition, Good heart-Wilcox Publisher, 2010.   |                |           |
| 3.  | Julian W Gardner, Micro Sensor MEMS and Smart Devices, John Wiley & Sons, 2001  |                |           |
| 4.  | P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995  |                |           |
| 5.  | Mikell P. Groover, Mitchell weiss, Roger N. Nagel, Nicholas G.Odrey, Industrial Robotics, Technology programming and Applications, 1986   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="http://nptel.ac.in/courses/112101099/">http://nptel.ac.in/courses/112101099/</a>   |                |           |
| 2.  | <a href="https://nptel.ac.in/courses/112/101/112101098/">https://nptel.ac.in/courses/112/101/112101098/</a>   |                |           |
| 3.  | <a href="https://nptel.ac.in/courses/112/107/112107289/">https://nptel.ac.in/courses/112/107/112107289/</a>   |                |           |
| 4.  | <a href="https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/">https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/</a> |                |           |



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|   |  |                  |            |            |             |               |     |                        |
|---|--|------------------|------------|------------|-------------|---------------|-----|------------------------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |     |                        |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |     |                        |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |     |                        |
|   |  | L                | T          | P          | C           | CA            | ESE | Total                  |
| <b>U19EEV36</b>   | <b>Modern Control Theory</b>   | 3                | 0          | 0          | 3           | 40            | 60  | 100                    |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Explain the concepts of basic and modern control system for the real time analysis and design of control systems.</li> <li>• Explain and apply concepts of state variables analysis.</li> <li>• Study and analyze non linear systems.</li> <li>• Analyze the concept of stability of nonlinear systems and categorization.</li> <li>• Apply the comprehensive knowledge of optimal theory for Control Systems.</li> </ul> |                  |            |            |             |               |     |                        |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               |     | <b>Knowledge Level</b> |
|   | <b>CO1:</b> Understand the basic concepts of states and state models   |                  |            |            |             |               |     | K2                     |
|   | <b>CO2:</b> Design the controllability and observability of a time invariant system  |                  |            |            |             |               |     | K5                     |
|   | <b>CO3:</b> Identify and analyze non-linear systems using describing function analysis   |                  |            |            |             |               |     | K4                     |
|   | <b>CO4:</b> Analyze linear and non-linear systems using Lyapunov function and design Lyapunov function for stable systems  |                  |            |            |             |               |     | K4                     |
| <b>CO5:</b> Formulate an optimal control problem and design optimal control signal. |  |                  |            |            |             |               | K5  |                        |
| <b>Pre-requisites</b>   | Control Systems  |                  |            |            |             |               |     |                        |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       | <b>CO/PSO Mapping</b> |       |       |       |       |
|--|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-----------------------|-------|-------|-------|-------|
| COs  | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |                       | PSOs  |       |       |       |
|  | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12                 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1   | 3                        | 2    |      |      |      |      |      |      |      |       |       | 2                     | 3     |       |       |       |
| CO 2   | 2                        | 3    | 2    |      |      |      |      |      |      |       |       | 2                     | 3     | 2     |       |       |
| CO 3   | 2                        | 3    | 2    |      |      |      |      |      |      |       |       | 2                     | 3     | 2     | 2     |       |
| CO 4   | 2                        | 3    | 3    |      |      |      |      |      |      |       |       | 2                     | 3     |       |       |       |
| CO 5   | 3                        | 3    |      |      |      |      |      |      |      |       |       | 2                     | 3     | 2     | 2     |       |

**Course Assessment Methods**



**Direct**

1. Continuous Assessment Test I, II &III
2. Assignment
3. End-Semester examinations



**Indirect**

1. Course – end Survey



| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>MATHEMATICAL PRELIMINARIES</b>   | <b>Periods</b> | <b>9</b>  |
| Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems– Non-uniqueness of state model – State diagrams for Continuous-Time State models.                  |   |                |           |
| <b>Unit - II</b>   | <b>STATE VARIABLE ANALYSIS</b>  | <b>Periods</b> | <b>9</b>  |
| Linear Continuous time models for Physical systems– Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability and Observability – Controllability and observability tests for Continuous-Time Invariant Systems– Controllability and Observability of State Model in Jordan Canonical form     |   |                |           |
| <b>Unit – III</b>  | <b>NON LINEAR SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone -Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions.          |   |                |           |
| <b>Unit - IV</b>   | <b>STABILITY ANALYSIS</b>   | <b>Periods</b> | <b>9</b>  |
| Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems- Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions– Variable gradient method– Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order. |   |                |           |
| <b>Unit – V</b>  | <b>OPTIMAL CONTROL</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | M.Gopal "Modern Control System Theory" John Wiley & Sons, 1993  |                |           |
| 2.   | Ogata, K., Modern Control Engineering, Prentice Hall of India Private Limited 2001.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Sinha, N.K., Control System, New Age International (P) Limited, Publishers 2002.  |                |           |
| 2.   | Kuo, B.C., Automatic Control System, Prentice Hall of India Private Limited 2002.   |                |           |
| 3.   | Nagrath, I.J. and Gopal, M., Control System Engineering, New Age International (P) Limited, Publishers 2003.  |                |           |
| 4.   | N K Sinha, Control Systems– New Age International – 3rd edition.  |                |           |
| 5.   | Donald E. Kirk, Optimal Control Theory an Introduction, Prentice – Hall Network series – First edition.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/108/106/108106024/">https://nptel.ac.in/courses/108/106/108106024/</a>   |                |           |
| 2.   | <a href="http://www.nptelvideos.in/2012/11/advanced-control-system-design_27.html">http://www.nptelvideos.in/2012/11/advanced-control-system-design_27.html</a>             |                |           |
| 3.   | <a href="https://nptel.ac.in/content/storage2/courses/101108047/module1/Lecture%201.pdf">https://nptel.ac.in/content/storage2/courses/101108047/module1/Lecture%201.pdf</a> |                |           |

|  |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
|--|---|----------------|-------------|-------------|-------------|------------------|-------------|-------------|-------------|---------------|---|------------------------|-----------------------|--------------|--------------|--------------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                |             |             |             |                  |             |             |             |               |  |                        |                       |              |              |              |
| Programme  | <b>B.E.</b>   | Programme Code |             |             |             |                  | <b>102</b>  | Regulation  |             |               | <b>2019</b>   |                        |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                |             |             |             | Semester         |             |             |             |               |   |                        |                       |              |              |              |
| Course Code  | Course Name   |                |             |             |             | Periods Per Week |             |             | Credit      | Maximum Marks |   |                        |                       |              |              |              |
|  |   |                |             |             |             | L                | T           | P           |             | C             | CA  | ESE                    | Total                 |              |              |              |
| <b>U19EEV37</b>  | <b>PLC &amp; SCADA</b>  |                |             |             |             | 3                | 0           | 0           | 3           | 40            | 60  | 100                    |                       |              |              |              |
| <b>Course Objective</b>  | The students should made to   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
|  | <ul style="list-style-type: none"> <li>Introduce the programmable logic controllers with the programming for different applications</li> <li>Educate SCADA and distributed control systems</li> <li>Educate Operator interfaces and DCS applications</li> </ul> |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                |             |             |             |                  |             |             |             |               |   | <b>Knowledge Level</b> |                       |              |              |              |
|  | <b>CO1:</b> Gain knowledge on the basics of automation system.  |                |             |             |             |                  |             |             |             |               |   | K2                     |                       |              |              |              |
|  | <b>CO2:</b> Analyze theory of operation of PLC and SCADA  |                |             |             |             |                  |             |             |             |               |   | K3                     |                       |              |              |              |
|  | <b>CO3:</b> Develop programming with PLC, SCADA and DCS.  |                |             |             |             |                  |             |             |             |               |   | K4                     |                       |              |              |              |
|  | <b>CO4:</b> Impart the knowledge of centralized monitoring and distributed control  |                |             |             |             |                  |             |             |             |               |   | K2                     |                       |              |              |              |
|  | <b>CO5:</b> Apply PLC, SCADA and DCS in industrial process control  |                |             |             |             |                  |             |             |             |               |   | K3                     |                       |              |              |              |
| <b>Pre-requisites</b>  |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |   |                |             |             |             |                  |             |             |             |               |   |                        | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | <b>Programme Outcomes (POs)</b>   |                |             |             |             |                  |             |             |             |               |   |                        | <b>PSOs</b>           |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>    | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>      | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b>  | <b>PO 11</b>  | <b>PO 12</b>           | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 2              | -           | 2           | 2           | 2                | 2           | -           | -           | 3             | 3   | -                      | 3                     | 2            | 2            | 2            |
| <b>CO 2</b>  | 3   | 3              | 3           | 3           | 3           | 3                | 3           | -           | -           | 3             | 3   | -                      | 3                     | 3            | 3            | 3            |
| <b>CO 3</b>  | 3   | 3              | 3           | 3           | 3           | 3                | 3           | -           | -           | 3             | 3   | -                      | 3                     | 3            | 3            | 3            |
| <b>CO 4</b>  | 3   | 3              | 3           | 3           | 3           | 3                | 2           | -           | -           | 3             | 3   | -                      | 3                     | 3            | 3            | 3            |
| <b>CO 5</b>  | 3   | 2              | 2           | 2           | 2           | 3                | 2           | -           | -           | 3             | 3   | -                      | 3                     | 2            | 2            | 2            |
| <b>Course Assessment Methods</b>   |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| <b>Direct</b>  |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| 1. Continuous Assessment Test I, II &III   |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| 2. Assignment  |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| 3. End-Semester examinations   |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| <b>Indirect</b>  |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |
| 1. Course – end Survey   |   |                |             |             |             |                  |             |             |             |               |   |                        |                       |              |              |              |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>PROGRAMMABLE LOGIC CONTROLLERS (PLCS)</b>  | <b>Periods</b> | <b>9</b>  |
| An overview and PLC hardware components: Programmable Logic Controllers - Parts of a PLC - Principles of operation - PLCs versus Computers - PLC size and application – The I/O section – Discrete I/O modules – Analog I/O modules – Special I/O modules – The CPU – Memory design – Memory types – Programming devices – Recording and retrieving data – PLC workstations. |   |                |           |
| <b>Unit - II</b>   | <b>PLC PROGRAMMING</b>  | <b>Periods</b> | <b>9</b>  |
| Basics of PLC programming: Processor memory organization–Programscan–PLC programming languages –Relay type instructions–Instruction addressing–Internal relay instructions–Programming EXAMINE IF CLOSED and EXAMINE IF OPEN instructions – Entering the ladder diagram – Modes of operation.  |   |                |           |
| <b>Unit – III</b>  | <b>PROGRAMMING TIMERS AND COUNTERS</b>  | <b>Periods</b> | <b>9</b>  |
| Programming timers: Mechanical timing relay – Timer instructions – On delay timer instruction – Off delay timer instruction – Retentive timers - Cascading timers. Programming counters: Counter instructions – Up counter – Down counter – Cascading counters – Combining counter and timer functions.  |   |                |           |
| <b>Unit - IV</b>   | <b>ADVANCED PLC PROGRAMMING AND APPLICATIONS</b>  | <b>Periods</b> | <b>9</b>  |
| Program control instructions: Master control reset instruction – Jump instruction and subroutines. Data manipulation instructions: Data manipulation – Data compare instructions. Math instructions. Sequencer and shift register instructions. Process control and Data Acquisition systems: Closed loop container filling process - ON/OFF liquid heating system           |   |                |           |
| <b>Unit – V</b>  | <b>SCADA</b>  | <b>Periods</b> | <b>9</b>  |
| Definition of SCADA – Applicable processes – Elements of SCADA systems – SCADA Architecture - operation and Control using SCADA - Development from telemetry – Dependence on communications & computers  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Frank D. Petruzella, —Programmable Logic Controllers, 3rd Edition, TataMcGraw Hill, New Delhi, 2010.  |                |           |
| 2.   | Stuart A. Boyer, —SCADA: Supervisory Control and Data Acquisition, 4th Edition, ISA Press, USA, 2009.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | DilipPatel—IntroductionPracticalPLC(ProgrammableLogicController)Programming GRIN Verlag 2009.   |                |           |
| 2.   | Mini S.Thomas, John D.McDonald, Power System SCADA and Smart Grids, CRC Press 2019.   |                |           |
| 3.   | GaryA.Dunning—IntroductiontoProgrammableLogicControllers ThomsonLearning Publications.2006.   |                |           |
| 4.   | KSManoj—IndustrialAutomationwithSCADA:Concepts,CommunicationsandSecurity Notion press 2019.   |                |           |
| 5.   | James Northcote-Green, Robert G. Wilson. —Control and Automation of Electrical Power Distribution Systems, CRC Press, 2006.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="http://jjackson.eng.ua.edu/courses/ece485/lectures/">http://jjackson.eng.ua.edu/courses/ece485/lectures/</a>   |                |           |
| 2.   | <a href="https://electrical-guru.com/subject.aspx?id=3&amp;code=6EE5A&amp;unitid=3&amp;topicid=18">https://electrical-guru.com/subject.aspx?id=3&amp;code=6EE5A&amp;unitid=3&amp;topicid=18</a> |                |           |
| 3.   | <a href="https://www.watelectrical.com/scada-applications-in-power-system/">https://www.watelectrical.com/scada-applications-in-power-system/</a>   |                |           |

|  |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
|--|--|------------------|-------------|-------------|-------------|---|------------------------|-------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
|                   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |             |  |                        |             |             |              |              |                       |              |              |              |              |
| Programme  | <b>B.E.</b>  | Programme Code   |             |             | <b>102</b>  | Regulation  |                        | <b>2019</b> |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             | Semester    |   |                        |             |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name  | Periods Per Week |             |             | Credit      | Maximum Marks   |                        |             |             |              |              |                       |              |              |              |              |
|  |  | L                | T           | P           |             | C   | CA                     | ESE         | Total       |              |              |                       |              |              |              |              |
| <b>U19EEV38</b>  | <b>Intellectual Property Rights</b>  | 3                | 0           | 0           | 3           | 40  | 60                     | 100         |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | <p>The students should made to</p> <ul style="list-style-type: none"> <li>The fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.</li> <li>The knowledge on patents, patent regime in India and abroad and registration aspects</li> <li>The knowledge on copyrights and its related rights and registration aspects</li> <li>The knowledge on trademarks and registration aspects</li> <li>The current trends in IPR and Govt. steps in fostering IPR</li> </ul> |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,   |                  |             |             |             |   | <b>Knowledge Level</b> |             |             |              |              |                       |              |              |              |              |
|  | <b>CO1:</b> Introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.   |                  |             |             |             |   | K3                     |             |             |              |              |                       |              |              |              |              |
|  | <b>CO2:</b> Disseminate knowledge on patents, patent regime in India and abroad and registration aspects   |                  |             |             |             |   | K3                     |             |             |              |              |                       |              |              |              |              |
|  | <b>CO3:</b> Disseminate knowledge on copyrights and its related rights and registration aspects.   |                  |             |             |             |   | K4                     |             |             |              |              |                       |              |              |              |              |
|  | <b>CO4:</b> Disseminate knowledge on trademarks and registration aspects   |                  |             |             |             |   | K4                     |             |             |              |              |                       |              |              |              |              |
| <b>CO5:</b> Aware about current trends in IPR and Govt. steps in fostering IPR                     |  |                  |             |             |             | K4  |                        |             |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  | Basic concepts and understanding of semiconductor device   |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |  |                  |             |             |             |   |                        |             |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)   |                  |             |             |             |   |                        |             |             |              |              | PSOs                  |              |              |              |              |
|  | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b>            | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3  | 2                | -           | -           | -           | -   | -                      | -           | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 2</b>  | 2  | -                | 3           | -           | -           | -   | -                      | -           | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 3</b>  | 2  | 2                | 1           | -           | -           | -   | -                      | -           | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 4</b>  | 2  | 1                | 3           | -           | -           | -   | -                      | -           | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 5</b>  | 2  | 2                | 3           | -           | -           | -   | -                      | -           | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>Course Assessment Methods</b>   |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| 1. Continuous Assessment Test I, II &III   |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| 2. Assignment  |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| 3. End-Semester examinations   |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |
| 1 Course – end Survey  |  |                  |             |             |             |   |                        |             |             |              |              |                       |              |              |              |              |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>Overview of Intellectual Property</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994 |   |                |           |
| <b>Unit - II</b>   | <b>Patents</b>  | <b>Periods</b> | <b>9</b>  |
| Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board   |   |                |           |
| <b>Unit – III</b>  | <b>Copy rights</b>  | <b>Periods</b> | <b>9</b>  |
| Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights  |   |                |           |
| <b>Unit - IV</b>   | <b>Trade marks</b>  | <b>Periods</b> | <b>9</b>  |
| Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellateboard   |   |                |           |
| <b>Unit – V</b>  | <b>Current Contour</b>  | <b>Periods</b> | <b>9</b>  |
| India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.   |                |           |
| 2.   | Neeraj, P., &Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | Subramanian, N., &Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from <a href="http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf">http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf</a>                                   |                |           |
| 2.   | World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from <a href="https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf">https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf</a> |                |           |
| 3.   | Journal of Intellectual Property Rights (JIPR): NISCAIR   |                |           |
| 4.   | Cell for IPR Promotion and Management ( <a href="http://cipam.gov.in/">http://cipam.gov.in/</a> )   |                |           |
| 5.   | World Intellectual Property Organisation ( <a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a> )  |                |           |
| 6.   | Office of the Controller General of Patents, Designs & Trademarks ( <a href="http://www.ipindia.nic.in/">http://www.ipindia.nic.in/</a> )   |                |           |

|  |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
|--|---|------------------|-------------|-------------|-------------|---------------|-------------|---|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |             |             |             |               |             |  |             |              |              |                       |              |              |              |              |
| Programme  | <b>B.E.</b>   | Programme Code   |             |             |             | <b>102</b>    | Regulation  | <b>2019</b>   |             |              |              |                       |              |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             |             |             | Semester      |             |   |             |              |              |                       |              |              |              |              |
| Course Code  | Course Name   | Periods Per Week |             |             | Credit      | Maximum Marks |             |   |             |              |              |                       |              |              |              |              |
|  |   | L                | T           | P           |             | C             | CA          | ESE   | Total       |              |              |                       |              |              |              |              |
| <b>U19EEOE1</b>  | <b>Electron Devices</b>   | 3                | 0           | 0           | 3           | 40            | 60          | 100   |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>• The construction, operation and characteristics of solid state switching devices.</li> <li>• The operation of voltage amplifiers</li> <li>• The performance of power amplifiers and feedback amplifiers.</li> <li>• The construction and operation of oscillators and multi vibrators.</li> <li>• The performance of wave shaping circuits.</li> </ul> |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |             |             |             |               |             | <b>Knowledge Level</b>  |             |              |              |                       |              |              |              |              |
|  | <b>CO1:</b> Analyze the characteristics of various semiconductor devices.   |                  |             |             |             |               |             | K3  |             |              |              |                       |              |              |              |              |
|  | <b>CO2:</b> Design and analyze the performance of BJT based voltage Amplifiers.   |                  |             |             |             |               |             | K3  |             |              |              |                       |              |              |              |              |
|  | <b>CO3:</b> Analyze the performance of power amplifiers and feedback amplifiers.  |                  |             |             |             |               |             | K4  |             |              |              |                       |              |              |              |              |
|  | <b>CO4:</b> Apply the Oscillator and Multi vibrator circuits for waveform generation  |                  |             |             |             |               |             | K4  |             |              |              |                       |              |              |              |              |
| <b>CO5:</b> Design a voltage regulator using rectifiers for power supply applications and construct the wave shaping circuits. |   |                  |             |             |             |               | K4          |   |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>  | Basic concepts and understanding of semiconductor device  |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak                             |   |                  |             |             |             |               |             |   |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)  |                  |             |             |             |               |             |   |             |              |              | PSOs                  |              |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>   | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 2                | -           | -           | -           | -             | -           | -   | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 2</b>  | 2   | -                | 3           | -           | -           | -             | -           | -   | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 3</b>  | 2   | 2                | 1           | -           | -           | -             | -           | -   | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 4</b>  | 2   | 1                | 3           | -           | -           | -             | -           | -   | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>CO 5</b>  | 2   | 2                | 3           | -           | -           | -             | -           | -   | -           | -            | -            | 1                     | 3            | -            | -            | -            |
| <b>Course Assessment Methods</b>   |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| <b>Direct</b>  |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| 1. Continuous Assessment Test I, II & III  |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| 2. Assignment  |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| 3. End-Semester examinations   |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>  |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |
| 1. Course – end Survey   |   |                  |             |             |             |               |             |   |             |              |              |                       |              |              |              |              |



| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>Semiconductor Devices</b>  | <b>Periods</b> | <b>9</b>  |
| Construction, Operation and characteristics of PN Junction Diode, Zener diode, BJT, MOSFET and UJT, Photodiode, Photo Transistor, LED.  |   |                |           |
| <b>Unit – II</b>  | <b>Voltage Amplifiers</b>   | <b>Periods</b> | <b>9</b>  |
| Biasing of BJT-RC Coupled Amplifier - Differential amplifier using BJT -Differential and Common mode gain, CMRR   |   |                |           |
| <b>Unit – III</b>   | <b>Power and Feedback Amplifiers</b>  | <b>Periods</b> | <b>9</b>  |
| Performance analysis of Class A, Class B, Class C and Class D - Basic concepts of feedback amplifiers- Topologies - Effect of negative feedback on input and output resistances, gain stability, distortion, bandwidth. |   |                |           |
| <b>Unit – IV</b>  | <b>Oscillators and Multi vibrators</b>  | <b>Periods</b> | <b>9</b>  |
| Oscillators, Barkhausen Criterion, RC phase shift oscillators, Wien Bridge and Hartley oscillators, Colpitts oscillators and UJT based saw tooth oscillator, Astable, Monostable, Bistable Multivibrators - operation.  |   |                |           |
| <b>Unit – V</b>   | <b>Power Supply and Wave shaping Circuits</b>   | <b>Periods</b> | <b>9</b>  |
| Performance analysis Half wave rectifier and full wave rectifier, Filters -Series and Shunt Voltage Regulator - Clippers and Clampers.  |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | 1. Jacob. Millman, Christos C.Halkias, Electronic Devices and Circuits, 3rd Edition ,Tata McGraw Hill Publishing Limited, New Delhi.          |                |           |
| 2.  | David A. Bell, Electronic Devices and Circuits,5th Edition,Oxford University Press,   |                |           |
| <b>References</b>   |   |                |           |
| 1.  | N.P.Deshpande, Electronic Devices and Circuits,1stEdition,Tata McGraw Hill Publishing Limited, New Delhi,2013.                                |                |           |
| 2.  | Thomas L Floyd, Electronic Devices, Prentice Hall of India, New Delhi,2011.   |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="http://aunewsblog.net">EC8252: Electronic Devices Important Questions, Question Bank, 2 Marks (aunewsblog.net)</a>                   |                |           |
| 2.  | <a href="http://jagranjosh.com">Electronic Devices – Chapter Notes and Important Questions for IIT JEE 2019 (jagranjosh.com)</a>              |                |           |
| 3.  | <a href="http://careerride.com">Electronic Devices &amp; Circuits - Electronic Engineering (MCQ) questions &amp; answers (careerride.com)</a> |                |           |
| 4.  | <a href="http://Sanfoundry">Electronic Devices and Circuits Questions and Answers - Sanfoundry</a>  |                |           |





**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
(Autonomous Institution, Affiliated to Anna University, Chennai)  
Elayampalayam, Tiruchengode – 637 205



|   |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
|---|---|------------------|-------------|-------------|-------------|---------------|-------------|------------------------|-------------|--------------|--------------|-----------------------|--------------|--------------|--------------|--------------|
| Programme   | <b>B.E.</b>   | Programme Code   | <b>102</b>  | Regulation  | <b>2019</b> |               |             |                        |             |              |              |                       |              |              |              |              |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             | Semester    |             |               |             |                        |             |              |              |                       |              |              |              |              |
| Course Code   | Course Name   | Periods Per Week |             |             | Credit      | Maximum Marks |             |                        |             |              |              |                       |              |              |              |              |
|   |   | L                | T           | P           | C           | CA            | ESE         | Total                  |             |              |              |                       |              |              |              |              |
| <b>U19EEOE2</b>   | <b>Electrical Safety</b>  | 3                | 0           | 0           | 3           | 40            | 60          | 100                    |             |              |              |                       |              |              |              |              |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Learn the basic concepts of the electrical safety rules, and regulations.</li> <li>• Learn the Expanding skills in identifying the presence of electrical hazards,</li> <li>• Learn the Testing procedure for electrical safety equipment and Energy Control Programs</li> <li>• Learn the importance of grounding and maintenance.</li> </ul> |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,  |                  |             |             |             |               |             | <b>Knowledge Level</b> |             |              |              |                       |              |              |              |              |
|   | <b>CO1:</b> Develop skills in investigative techniques for determining the cause of electrical accidents, fires and explosions.   |                  |             |             |             |               |             | K2                     |             |              |              |                       |              |              |              |              |
|   | <b>CO2:</b> Understand to Select appropriate safety method for low, medium and high voltage equipment.  |                  |             |             |             |               |             | K2                     |             |              |              |                       |              |              |              |              |
|   | <b>CO3:</b> Analyze and apply various grounding and bonding techniques.   |                  |             |             |             |               |             | K2                     |             |              |              |                       |              |              |              |              |
|   | <b>CO4:</b> Assess and provide solutions to a practical case study.   |                  |             |             |             |               |             | K2                     |             |              |              |                       |              |              |              |              |
|   | <b>CO5:</b> Understand the Electrical safety on medical equipment.  |                  |             |             |             |               |             | K2                     |             |              |              |                       |              |              |              |              |
| <b>Pre-requisites</b>   | Basic concepts and understanding of magnetic fields   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>CO / PO Mapping</b>  |   |                  |             |             |             |               |             |                        |             |              |              | <b>CO/PSO Mapping</b> |              |              |              |              |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak                  |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>COs</b>  | Programme Outcomes (POs)  |                  |             |             |             |               |             |                        |             |              |              |                       | PSOs         |              |              |              |
|   | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>          | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>   | 3   | 2                |             | 2           |             |               |             |                        |             |              |              | 2                     | 3            |              | 2            |              |
| <b>CO 2</b>   | 3   | 3                | 2           |             | 2           | 2             |             |                        |             |              |              | 2                     | 3            | 2            | 2            |              |
| <b>CO 3</b>   | 3   | 3                | 2           |             | 2           | 2             |             |                        |             |              |              | 2                     | 3            | 2            | 3            |              |
| <b>CO 4</b>   | 3   | 2                |             |             |             | 2             |             |                        |             |              |              | 2                     | 3            |              | 2            |              |
| <b>CO 5</b>   | 3   | 2                |             |             | 2           | 2             |             |                        |             |              |              | 2                     | 3            |              | 2            |              |
| <b>Course Assessment Methods</b>  |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Direct</b>   |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| 1. Continuous Assessment Test I, II &III<br>2. Assignment<br>3. End-Semester examinations |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| <b>Indirect</b>   |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |
| 1. Course – end Survey  |   |                  |             |             |             |               |             |                        |             |              |              |                       |              |              |              |              |

| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION AND HAZARDS OF ELECTRICITY</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction – Hazard Analysis: Primary and Secondary hazards- Arc, Blast, Shocks - Causes and Effects - Summary of Causes - Protection and Precaution - Injury and Death protective strategies – IE Rules 1956 – Basic rules for new installations: Power system, Domestic and Industry (Qualitative treatment only)  |   |                |           |
| <b>Unit - II</b>   | <b>ELECTRICAL SAFETY EQUIPMENT</b>  | <b>Periods</b> | <b>9</b>  |
| General inspection and Testing procedure for electrical safety equipment – Electrical safety equipment for external protection: Flash and Thermal protection - Head and Eye protection – Insulation protection. Electrical safety equipment for internal protection: Over voltage, Short circuit, Earth Fault, Leakage current, High/Low frequency – Electrician’s Safety Kit and Materials. |   |                |           |
| <b>Unit – III</b>  | <b>SAFETY PROCEDURES</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction - Six-Step Safety Method - Job briefings - Energized or De-energized - Safe switching of power systems - Energy Control Programs - General Energy Control Programs -Lockout- Tag out –Placement of safety grounds - Barriers and Warning signs - Tools and Test equipment - Field marking of potential hazards – Shock avoidance techniques- One-minute safety audit.           |   |                |           |
| <b>Unit - IV</b>   | <b>GROUNDING AND ELECTRICAL MAINTENANCE</b>   | <b>Periods</b> | <b>9</b>  |
| Need for Electrical Equipment grounding - System grounding - Equipment grounding- Types of Earthing – Earth Testing for electrical equipment’s in Power house and Industry - Eight Step Maintenance program – Maintenance requirements for specific equipment and location - IEC and UL standard.  |   |                |           |
| <b>Unit – V</b>  | <b>VOLTAGE SAFETY SYNOPSIS AND MEDICAL SAFETY MANAGEMENT</b>  | <b>Periods</b> | <b>9</b>  |
| Equipment’s grounding - Safety equipment’s and safety procedures for low voltage and high voltage system- Electrical safety around electronic circuits - Electrical safety for medical equipment like Over current safety, Isolation, EMI and Harmonics - Accident Prevention- Accident Investigation- First Aid- Rescue Techniques - Safety Audits.   |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | John Cadick, Mary Capelli-Schellpfeffer, Dennis neitzel, “Electrical Safety Handbook”, Mcgraw Hill Publishing Company Ltd., 3rd Edition, 1994.  |                |           |
| 2.   | Dennis Neitzel and Al Winfield, “Electrical Safety Handbook”, McGraw-Hill Education, 4th Edition, 2012.   |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Mohamed A El-Sharkawi, “Electric Safety: Practice and Standards”, CRC press, New York, 2013.  |                |           |
| 2.   | Martha J. Boss and Gayle Nicoll, “Electrical Safety: Systems, Sustainability, and Stewardship”, CRC press, New York, 2014.  |                |           |
| 3.   | Ray A. Jones and Jane g. Jones, “The Electrical Safety Program Guide”, National Fire Protection Association, Quincy, 2011.  |                |           |
| 4.   | James R. White “Electrical Safety: A Practical Guideto OSHA and NFPA 70E, American Technical Publishers, 2015   |                |           |
| 5.   | Peter E. “Principles of Electrical Safety” Sutherland · 2014  |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | E-Book: Johncadick, Marycapelli-schellpfeffer, Dennisneitzel, “Electrical Safety Handbook”, McGraw Hill publishing company Ltd., 3rd Edition, 1994.   |                |           |
| 2.   | <a href="https://installist.files.wordpress.com/2009/12/electrical-safety-handbook.pdf">https://installist.files.wordpress.com/2009/12/electrical-safety-handbook.pdf</a>   |                |           |
| 3.   | <a href="https://www.accessengineeringlibrary.com/content/book/9781260134858">https://www.accessengineeringlibrary.com/content/book/9781260134858</a>   |                |           |
| 4.   | Video Link: Electrical Safety in the Workplace Seminar DVD - NFPA National Fire Protection Association. <a href="http://www.nfpa.org/training-and-events/archived/training-videos/electrical-safety-videos">http://www.nfpa.org/training-and-events/archived/training-videos/electrical-safety-videos</a> |                |           |

|   |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
|---|--|------------------|-------------|-------------|---|---------------|-------------|------------------------|-------------|--------------|--------------|----------------|-----------------------|--------------|--------------|--------------|
|    | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205  |                  |             |             |  |               |             |                        |             |              |              |                |                       |              |              |              |
| Programme   | <b>B.E.</b>  | Programme Code   |             |             | <b>102</b>  | Regulation    | <b>2019</b> |                        |             |              |              |                |                       |              |              |              |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |             |             | Semester  |               |             |                        |             |              |              |                |                       |              |              |              |
| Course Code   | Course Name  | Periods Per Week |             |             | Credit  | Maximum Marks |             |                        |             |              |              |                |                       |              |              |              |
|   |  | L                | T           | P           |   | C             | CA          | ESE                    | Total       |              |              |                |                       |              |              |              |
| <b>U19EEOE3</b>   | <b>Energy Auditing</b>   | 3                | 0           | 0           | 3   | 40            | 60          | 100                    |             |              |              |                |                       |              |              |              |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Understand energy scenario and general aspects of energy audit.</li> <li>• Learn about methods and concept of energy audit</li> <li>• Understand the energy utilization pattern including wastage and its management</li> </ul> |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |             |             |   |               |             | <b>Knowledge Level</b> |             |              |              |                |                       |              |              |              |
|   | <b>CO1:</b> Understand the basic concepts of energy audit  |                  |             |             |   |               |             | K2                     |             |              |              |                |                       |              |              |              |
|   | <b>CO2:</b> Explain different types of energy audit, maximizing and optimizing system efficiency.  |                  |             |             |   |               |             | K2                     |             |              |              |                |                       |              |              |              |
|   | <b>CO3:</b> prepare and present energy audit report  |                  |             |             |   |               |             | K2                     |             |              |              |                |                       |              |              |              |
|   | <b>CO4:</b> Identify energy saving potential of thermal and electrical systems   |                  |             |             |   |               |             | K2                     |             |              |              |                |                       |              |              |              |
| <b>CO5:</b> Discuss Energy audit instruments, Procedures and Techniques   |  |                  |             |             |   |               | K2          |                        |             |              |              |                |                       |              |              |              |
| <b>Pre-requisites</b>   |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |  |                  |             |             |   |               |             |                        |             |              |              |                | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>  | Programme Outcomes (POs)   |                  |             |             |   |               |             |                        |             |              |              |                | PSOs                  |              |              |              |
|   | <b>PO 1</b>  | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b>   | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b>   | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>   | 3  | 3                | -           | 2           | 2   | 2             | 2           | -                      | -           | 3            | 3            | -              | 3                     | 2            | 2            | 2            |
| <b>CO 2</b>   | 3  | 3                | 3           | 3           | 3   | 3             | 3           | -                      | -           | 3            | 3            | -              | 3                     | 3            | 3            | 3            |
| <b>CO 3</b>   | 3  | 3                | 3           | 3           | 3   | 3             | 3           | -                      | -           | 3            | 3            | -              | 3                     | 3            | 3            | 3            |
| <b>CO 4</b>   | 3  | 3                | 3           | 3           | 3   | 3             | 2           | -                      | -           | 3            | 3            | -              | 3                     | 3            | 3            | 3            |
| <b>CO 5</b>   | 3  | 3                | 2           | 2           | 2   | 3             | 2           | -                      | -           | 3            | 3            | -              | 3                     | 2            | 2            | 2            |
| <b>Course Assessment Methods</b>  |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <b>Direct</b>   |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp; III</li> <li>2. Assignment</li> <li>3. End-Semester examinations</li> </ol>  |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <b>Indirect</b>   |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <ol style="list-style-type: none"> <li>1. Course – end Survey</li> </ol>  |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <b>Content of the syllabus</b>  |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |
| <b>Unit – I</b>   | <b>ENERGY AUDIT CONCEPTS</b>   |                  |             |             |   |               |             |                        |             |              |              | <b>Periods</b> | <b>9</b>              |              |              |              |
| NeedofEnergyaudit–Typesofenergyaudit–Energymanagement(audit)approach–understandingenergycosts<br>– Bench marking – Energy performance – Matching energy use to requirement – Maximizing system efficiencies -<br>Optimizing the input energy requirements -Duties and responsibilities of energy auditors- Energy audit instruments<br>– Procedures and Techniques. |  |                  |             |             |   |               |             |                        |             |              |              |                |                       |              |              |              |

|  |   |                |           |
|--|---|----------------|-----------|
| <b>Unit - II</b>   | <b>ENERGY AUDIT OF MOTORS</b>   | <b>Periods</b> | <b>9</b>  |
| Classification of Motors, Parameters related to Motors, Efficiency of a Motor, Energy Conservation in Motors, BEE Star Rating and Labelling.   |   |                |           |
| <b>Unit – III</b>  | <b>ENERGY AUDIT OF LIGHTING SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Fundamentals of Lighting, Different Lighting Systems, Ballasts, Fixtures (Luminaries), Reflectors, Lenses and Louvres, Lighting Control Systems, Lighting System Audit, Energy Saving Opportunities  |   |                |           |
| <b>Unit - IV</b>   | <b>ENERGY AUDIT OF HVAC SYSTEMS</b>   | <b>Periods</b> | <b>9</b>  |
| Introduction to HVAC, Components of Air – Conditioning System, Types of Air – Conditioning Systems, Human Comfort Zone and Psychrometry, Vapour – Compression Refrigeration Cycle, Energy Use Indices, Impact of Refrigerants on Environment and Global Warming, Energy – Saving Measures in HVAC, Star Rating and Labelling by BEE. |   |                |           |
| <b>Unit – V</b>  | <b>ENERGY AUDIT OF BOILERS AND FURNACES</b>   | <b>Periods</b> | <b>9</b>  |
| Energy Audit of Boilers: Classification of Boilers, Parts of Boiler, Efficiency of a Boiler, Role of excess Air in Boiler Efficiency, Energy Saving Methods. Energy Audit of Furnace: Parts of a Furnace, classification of Furnaces, Energy saving Measures in Furnaces, Furnace Efficiency.  |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Smith, C. B., Energy Management Principles, Pergamum, 2007  |                |           |
| 2.   | Handbook of Energy Audit, Sonal Desai, Mcgraw Hill Education Private Ltd.,  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.  |                |           |
| 2.   | Energy Conservation guide book Patrick/Patrick/Fardo (Prentice hall1993)  |                |           |
| 3.   | De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.   |                |           |
| 4.   | Industrial Energy Conservation Manuals, MIT Press, Mass, 1982   |                |           |
| 5.   | Industrial Energy Management and Utilisation -L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington, 1988)   |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://iare.ac.in/sites/default/files/iare_EAM_lecture%20notes.pdf">https://iare.ac.in/sites/default/files/iare_EAM_lecture%20notes.pdf</a>   |                |           |
| 2.   | <a href="https://beeindia.gov.in/sites/default/files/1Ch3.pdf">https://beeindia.gov.in/sites/default/files/1Ch3.pdf</a>   |                |           |
| 3.   | <a href="http://behineh-sazan.ir/wp-content/uploads/2017/01/Thumann-Albert_-Niehus-Terry_-Younger-William-J-Handbook-of-Energy-Audits-9th-Edition-Fairmont-Press-Inc-2013r.pdf">http://behineh-sazan.ir/wp-content/uploads/2017/01/Thumann-Albert_-Niehus-Terry_-Younger-William-J-Handbook-of-Energy-Audits-9th-Edition-Fairmont-Press-Inc-2013r.pdf</a> |                |           |



**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
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Elayampalayam, Tiruchengode – 637 205



|  |   |                  |            |            |             |               |                        |       |
|--|---|------------------|------------|------------|-------------|---------------|------------------------|-------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |                        |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   |             |               |                        |       |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |                        |       |
|  |   | L                | T          | P          | C           | CA            | ESE                    | Total |
| <b>U19EEOE4</b>  | <b>Energy Storage Technologies</b>  | 3                | 0          | 0          | 3           | 40            | 60                     | 100   |
| Course Objective   | The students should made to <ul style="list-style-type: none"> <li>Explore the fundamentals, technologies and applications of energy storage</li> </ul> |                  |            |            |             |               |                        |       |
| Course Outcome   | At the end of the course, the student should be able to,  |                  |            |            |             |               | <b>Knowledge Level</b> |       |
|  | <b>CO1:</b> Recall the historical perspective and technical methods of energy storage   |                  |            |            |             |               | K1                     |       |
|  | <b>CO2:</b> Explain the technical methods of energy storage   |                  |            |            |             |               | K2                     |       |
|  | <b>CO3:</b> Determine the performance factors of energy storage systems.  |                  |            |            |             |               | K5                     |       |
|  | <b>CO4:</b> Identify applications for renewable energy systems.   |                  |            |            |             |               | K3                     |       |
| <b>CO5:</b> Explain the Hydrogen fuel cells and flow batteries |   |                  |            |            |             | K3            |                        |       |
| Pre-requisites   | -   |                  |            |            |             |               |                        |       |

| CO / PO Mapping<br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |                          |      |      |      |      |      |      |      |      |       |       |       | CO/PSO Mapping |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|----------------|-------|-------|-------|
| COs   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs           |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 2                        | 2    |      |      |      |      |      |      |      |       |       |       | 2              |       |       |       |
| CO 2  | 2                        | 2    | 1    |      |      |      |      |      |      |       |       | 2     | 2              |       |       |       |
| CO 3  | 2                        | 2    | 1    |      |      |      |      |      |      |       |       | 2     | 2              | 1     | 1     |       |
| CO 4  | 2                        | 2    | 2    |      |      |      |      |      |      |       |       | 2     | 2              | 1     | 1     |       |
| CO 5  | 2                        | 2    | 2    |      |      |      |      |      |      |       |       | 2     | 2              | 1     | 2     | 2     |

**Course Assessment Methods**

|   |
|---|
| <b>Direct</b>                             |
| 1. Continuous Assessment Test I, II & III |
| 2. Assignment                             |
| 3. End-Semester examinations              |
| <b>Indirect</b>                           |
| 1. Course – end Survey                    |

| <b>Content of the syllabus</b>  |  |                |           |
|---|--|----------------|-----------|
| <b>Unit – I</b>   | <b>Storage: Historical Perspective, Introduction And Changes</b>   | <b>Periods</b> | <b>9</b>  |
| Storage Needs - Variations in Energy Demand - Variations in Energy Supply - Interruptions in Energy Supply - Transmission Congestion - Demand for Portable Energy - Demand and scale requirements - Environmental and sustainability issues.  |  |                |           |
| <b>Unit – II</b>  | <b>Technical methods of storage</b>  | <b>Periods</b> | <b>9</b>  |
| Introduction: Energy and Energy Transformations, Potential energy (pumped hydro, compressed air, springs) - Kinetic energy (mechanical flywheels) - Thermal energy without phase change passive (adobe) and active (water) - Thermal energy with phase change (ice, molten salts, steam) - Chemical energy (hydrogen, methane, gasoline, coal, oil) - Electrochemical energy (batteries, fuel cells) - Electrostatic energy (capacitors), Electromagnetic energy (superconducting magnets) - Different Types of Energy Storage Systems  |  |                |           |
| <b>Unit – III</b>   | <b>Performance Factors of Energy Storage Systems</b>   | <b>Periods</b> | <b>9</b>  |
| Energy capture rate and efficiency - Discharge rate and efficiency - Dispatch ability and load flowing characteristics, scale flexibility, durability – Cycle lifetime, mass and safety – Risks of fire, explosion, toxicity - Ease of materials, recycling and recovery - Environmental consideration and recycling , Merits and demerits of different types of Storage  |  |                |           |
| <b>Unit – IV</b>  | <b>Application consideration</b>   | <b>Periods</b> | <b>9</b>  |
| Comparing Storage Technologies - Technology options- Performance factors and metrics - Efficiency of Energy Systems - Energy Recovery -Battery Storage System: Introduction with focus on Lead Acid and Lithium - Chemistry of Battery Operation, Power storage calculations, Reversible reactions, Charging patterns, Battery Management systems, System Performance, Areas of Application of Energy Storage: Waste heat recovery, Solar energy storage, Green house heating, Power plant applications, Drying and heating for process industries, energy storage in automotive applications in hybrid and electric vehicles |  |                |           |
| <b>Unit – V</b>   | <b>Hydrogen fuel cells and flow batteries</b>  | <b>Periods</b> | <b>9</b>  |
| Hydrogen Economy and Generation Techniques, Storage of Hydrogen, Energy generation - Super capacitors: properties, power calculations - Operation and Design methods - Hybrid Energy Storage: Managing peak and Continuous power needs, options - Level 1: (Hybrid Power generation) Bacitor “Battery + Capacitor” Combinations: need, operation and Merits; Level 2: (Hybrid Power Generation) Bacitor + Fuel Cell or Flow Battery operation-Applications: Storage for Hybrid Electric Vehicles, Regenerative Power, capturing methods.  |  |                |           |
| <b>Total Periods</b>  |  |                | <b>45</b> |
| <b>Text Books</b>   |  |                |           |
| 1.  | Robert A.Huggins”Energy Storage Fundamentals ,Materials and Applications “second edition   |                |           |
| <b>References</b>   |  |                |           |
| 1.  | Detlef Stolten,“Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications”, Wiley, 2010.  |                |           |
| 2.  | Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, “Electrochemical Technologies for Energy Storage and Conversion”, John Wiley and Sons, 2012 |                |           |
| 3.  | Francois Beguin and Elzbieta Frackowiak ,“Super capacitors”, Wiley, 2013.  |                |           |
| 4.  | Doughty Liaw, Narayan and Srinivasan, “Batteries for Renewable Energy Storage”, The Electrochemical Society, New Jersey, 2010.                         |                |           |
| <b>E-Resources</b>  |  |                |           |
| 1.  | <a href="http://www.springer.com/gp/book/9783662532744">http://www.springer.com/gp/book/9783662532744</a>  |                |           |
| 2.  | <a href="http://www.springer.com/gp/book/9783319212388">http://www.springer.com/gp/book/9783319212388</a>  |                |           |

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|   |  |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
|---|--|------------------|------------|------------|-------------|---------------|------|-----------------|-------|-------|-------|-----------------------|-------|-------|-------|-------|
| Programme   | <b>B.E.</b>  | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |      |                 |       |       |       |                       |       |       |       |       |
| Department  | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>  |                  |            | Semester   |             |               |      |                 |       |       |       |                       |       |       |       |       |
| Course Code   | Course Name  | Periods Per Week |            |            | Credit      | Maximum Marks |      |                 |       |       |       |                       |       |       |       |       |
|   |  | L                | T          | P          |             | C             | CA   | ESE             | Total |       |       |                       |       |       |       |       |
| <b>U19EEOE5</b>   | <b>Biomass Energy Systems</b>  | 3                | 0          | 0          | 3           | 50            | 50   | 100             |       |       |       |                       |       |       |       |       |
| <b>Course Objective</b>   | The students should made to <ul style="list-style-type: none"> <li>• Give an overview of biomass energy source</li> <li>• Create an understanding of biomass derived fuel system</li> <li>• Generate understanding on energy utilization of bio-based fuel.</li> </ul> |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
| <b>Course Outcome</b>   | At the end of the course, the student should be able to,   |                  |            |            |             |               |      | Knowledge Level |       |       |       |                       |       |       |       |       |
|   | <b>CO1:</b> To identify an appropriate method of energy content of various bio- fuels Energy plantation and Characteristics.   |                  |            |            |             |               |      | K2              |       |       |       |                       |       |       |       |       |
|   | <b>CO2:</b> To develop a clear idea on various organic material derived from recently living organisms, which includes plants, animals, and their byproducts that can store sunlight in the form of chemical energy.   |                  |            |            |             |               |      | K5              |       |       |       |                       |       |       |       |       |
|   | <b>CO3:</b> To evaluate physical, and agrochemical conversion methods.   |                  |            |            |             |               |      | K2              |       |       |       |                       |       |       |       |       |
|   | <b>CO4:</b> To realize the appropriate method of most narrow sense it is a synonym to biogas, which is gas derived from a chemical reaction in gasification.   |                  |            |            |             |               |      | K2              |       |       |       |                       |       |       |       |       |
| <b>CO5:</b> To give an overview of the production of bio-fuel, bio-gas along with various biomass energy conversion routes and their energy utilization.    |  |                  |            |            |             |               | K3   |                 |       |       |       |                       |       |       |       |       |
| <b>Pre-requisites</b>   | Basic concepts of biomass energy sources and understanding of conversion methods include bio-gas, bio-diesel power generation.   |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak  |  |                  |            |            |             |               |      |                 |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |       |
| <b>COs</b>  | Programme Outcomes (POs)   |                  |            |            |             |               |      |                 |       |       |       |                       | PSOs  |       |       |       |
|   | PO 1   | PO 2             | PO 3       | PO 4       | PO 5        | PO 6          | PO 7 | PO 8            | PO 9  | PO 10 | PO 11 | PO 12                 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3  | 2                | 3          | 1          | 3           | 2             | 2    |                 | 2     |       | 1     | 1                     | 3     | 1     | 2     | 1     |
| CO 2  | 3  | 1                | 2          | 1          | 1           | 3             | 1    |                 |       |       | 2     | 1                     | 1     | 2     | 1     | 2     |
| CO 3  | 2  | 2                | 2          |            | 2           |               | 2    | 1               |       |       | 1     | 3                     | 2     | 3     | 3     |       |
| CO 4  | 3  | 1                | 3          | 1          | 1           | 1             |      |                 |       |       |       |                       | 3     | 2     | 1     | 2     |
| CO 5  | 2  | 2                | 1          |            | 2           | 2             | 1    |                 | 1     |       | 2     | 2                     | 3     | 1     | 2     |       |
| <b>Course Assessment Methods</b>  |  |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
| <b>Direct</b>   |  |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
| <ol style="list-style-type: none"> <li>1. Continuous Assessment Test I, II &amp;III</li> <li>2. Assignment</li> <li>3. End-Semester examinations</li> </ol> |  |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
| <b>Indirect</b>   |  |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |
| <ol style="list-style-type: none"> <li>1. Course – end Survey</li> </ol>  |  |                  |            |            |             |               |      |                 |       |       |       |                       |       |       |       |       |



| <b>Content of the syllabus</b>   |   |                |           |
|--|---|----------------|-----------|
| <b>Unit – I</b>  | <b>INTRODUCTION</b>   | <b>Periods</b> | <b>9</b>  |
| Biomass energy sources, energy content of various Bio – fuels, Energy plantation, origin of Biomass photo synthesis process, Biomass Characteristics, sustainability of Biomass.   |   |                |           |
| <b>Unit - II</b>   | <b>BIO POWER PLANTS AND BIOMASS CONVERSION METHODS</b>  | <b>Periods</b> | <b>9</b>  |
| Bio Power generation routes, Basic Thermodynamic cycles in Bio power generation; Brayton cycle, Sterling cycle, Rankine cycle, Co-generation cycle. Biomass based steam power plant. Biomass conversion methods- Thermo chemical, Biochemical- explanation, and flowchart. |   |                |           |
| <b>Unit – III</b>  | <b>PHYSICAL &amp; AGROCHEMICAL CONVERSION</b>   | <b>Periods</b> | <b>9</b>  |
| Briquetting, Pelletization, Agrochemical, fuel Extraction, Thermo chemical Conversion: Direct combustion for heat, Domestic cooking & heating.   |   |                |           |
| <b>Unit - IV</b>   | <b>BIOMASS GASIFICATION</b>   | <b>Periods</b> | <b>9</b>  |
| Chemical reaction in gasification, Producer gas& the constituents, Types of gasifiers. Fixed bed gasifiers, Fluidized bed gasifiers. Liquefaction: Liquefaction through pyrolysis & Methanol synthesis, application of producer gas in I C Engines.                        |   |                |           |
| <b>Unit – V</b>  | <b>BIO- GAS AND BIO– DIESEL POWER GENERATION</b>  | <b>Periods</b> | <b>9</b>  |
| Ethanol as an automobile fuel, Ethanol production & its use in engines. Bio Diesel from edible & non-edible oils, Production of Bio diesel from Honge & Jatropha seeds, use of bio diesel in I C engines, Performance analysis of diesel engines using bio diesel.         |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Sorensen B.,” Renewable Energy, Fourth Edition, Academic press, 2010.   |                |           |
| 2.   | Mukunda H. S.,” Understanding Clean Energy and Fuels from Biomass, Wiley India,2011   |                |           |
| 3.   | Erik Dahlquist,” Biomass as Energy Source Resources, Systems and Applications, “CRC press, 2013.  |                |           |
| 4.   | Vladimir Strezov, Hossain Md. Anawar,” Renewable Energy Systems from Biomass: Efficiency, Innovation and Sustainability,” CRC press, 2019.  |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Klass D. L. (1998);Biomass for Renewable Energy, Fuels, and Chemicals, Academic Press, USA.   |                |           |
| 2.   | Higman C. and Burt M v d (2003);Gasification, Elsevier Science, USA.  |                |           |
| 3.   | Rosillo-Calle F. and Francisco R. (2007); The Biomass Assessment Handbook: Bioenergy for a Sustainable Environment, Earthscan   |                |           |
| 4.   | Mittal K. M. (1996); Biogas systems: Principles and Applications, New Age International.  |                |           |
| 5.   | Stassen H. E. Quaak P. and Knoef H. (1999); Energy from Biomass: A Review of Combustion and Gasification Technologies, World Bank Publication.  |                |           |
| <b>E-Resources</b>   |   |                |           |
| 1.   | <a href="https://nptel.ac.in/courses/103/103/103103206/">https://nptel.ac.in/courses/103/103/103103206/</a>   |                |           |
| 2.   | <a href="https://oyc.yale.edu/geology-and-geophysics/gg-140/lecture-34">https://oyc.yale.edu/geology-and-geophysics/gg-140/lecture-34</a>   |                |           |
| 3.   | <a href="https://lecturenotes.in/notes/21095-note-for-renewable-energy-system-res-by-hymavathi-ulli">https://lecturenotes.in/notes/21095-note-for-renewable-energy-system-res-by-hymavathi-ulli</a> |                |           |
| 4.   | <a href="https://che.utexas.edu/course/che359&amp;384/lecture_notes.html">https://che.utexas.edu/course/che359&amp;384/lecture_notes.html</a>   |                |           |



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|  |   |                  |             |             |             |               |             |                        |             |              |              |              |                       |              |              |              |
|--|---|------------------|-------------|-------------|-------------|---------------|-------------|------------------------|-------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b>  | Regulation  | <b>2019</b> |               |             |                        |             |              |              |              |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             | Semester    |             |               |             |                        |             |              |              |              |                       |              |              |              |
| Course Code  | Course Name   | Periods Per Week |             |             | Credit      | Maximum Marks |             |                        |             |              |              |              |                       |              |              |              |
|  |   | L                | T           | P           | C           | CA            | ESE         | Total                  |             |              |              |              |                       |              |              |              |
| <b>U19EEOE6</b>  | <b>Energy Efficient Lighting System</b>   | 3                | 0           | 0           | 3           | 40            | 60          | 100                    |             |              |              |              |                       |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>An introduction to the fundamentals of illumination engineering and architectural lighting design.</li> <li>Impart lighting fundamentals, measurement, and technology and their application in the analysis and design of architectural lighting systems.</li> <li>Factors to be considering while designing indoor and outdoor illumination schemes.</li> </ul> |                  |             |             |             |               |             |                        |             |              |              |              |                       |              |              |              |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |             |             |             |               |             | <b>Knowledge Level</b> |             |              |              |              |                       |              |              |              |
|  | <b>CO1:</b> Apply basic engineering to understand concept of lighting system, selection of lighting factors effecting on lighting scheme.   |                  |             |             |             |               |             | K3                     |             |              |              |              |                       |              |              |              |
|  | <b>CO2:</b> Identify the criteria for the selection of lamps, measurement of light and law of illuminations. and lighting systems for an indoor or outdoor space  |                  |             |             |             |               |             | K3                     |             |              |              |              |                       |              |              |              |
|  | <b>CO3:</b> Design and Evaluate different types of lighting scheme designs for indoor lighting and selection of luminary to meet the specified needs with appropriate consideration.  |                  |             |             |             |               |             | K4                     |             |              |              |              |                       |              |              |              |
|  | <b>CO4:</b> Perform calculations on photometric performance of light sources and luminaries for outdoor purposes.   |                  |             |             |             |               |             | K4                     |             |              |              |              |                       |              |              |              |
|  | <b>CO5:</b> Design special lighting scheme to meet the specified needs with appropriate consideration in monument Sports and aviation lighting.   |                  |             |             |             |               |             | K4                     |             |              |              |              |                       |              |              |              |
| <b>Pre-requisites</b>  | Basic concepts and understanding of magnetic fields   |                  |             |             |             |               |             |                        |             |              |              |              |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak |   |                  |             |             |             |               |             |                        |             |              |              |              | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | Programme Outcomes (POs)  |                  |             |             |             |               |             |                        |             |              |              |              | PSOs                  |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>            | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 1                | 2           | -           | 2           | -             | -           | -                      | -           | -            | -            | 1            | 3                     | -            | -            | -            |
| <b>CO 2</b>  | 3   | 1                | 2           | -           | -           | -             | -           | -                      | -           | -            | -            | 1            | 3                     | -            | -            | -            |
| <b>CO 3</b>  | 3   | 2                | 2           | -           | 2           | -             | -           | -                      | -           | -            | -            | 1            | 3                     | -            | -            | -            |
| <b>CO 4</b>  | 3   | 2                | 2           | -           | 2           | -             | -           | -                      | -           | -            | -            | 1            | 3                     | -            | -            | -            |
| <b>CO 5</b>  | 3   | 2                | 2           | -           | 2           | -             | -           | -                      | -           | -            | -            | 1            | 3                     | -            | -            | -            |
| <b>Course Assessment Methods</b>   |   |                  |             |             |             |               |             |                        |             |              |              |              |                       |              |              |              |
| <b>Direct</b>  |   |                  |             |             |             |               |             |                        |             |              |              |              |                       |              |              |              |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations         |   |                  |             |             |             |               |             |                        |             |              |              |              |                       |              |              |              |

| <b>Indirect</b>  |   |                |           |
|--|---|----------------|-----------|
| 1. Course – end survey   |   |                |           |
| <b>Content of the syllabus</b>   |   |                |           |
| <b>Unit – I</b>  | <b>Introduction of Light:</b>   | <b>Periods</b> | <b>9</b>  |
| Radiation, colour and eye vision. Types of illumination, Day lighting, Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Colour rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semi indirect, Lighting scheme, General and localized   |   |                |           |
| <b>Unit - II</b>   | <b>Light Source and measurement light:</b>  | <b>Periods</b> | <b>9</b>  |
| Incandescent, electric discharge, fluorescent and LED light, Luminaries and control circuits. Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Laws of illumination, Inverse square law and Lambert’s Cosine law, Illumination at horizontal and vertical plane from point source, Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source  |   |                |           |
| <b>Unit – III</b>  | <b>Design of Interior Lighting:</b>   | <b>Periods</b> | <b>9</b>  |
| Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilization and factors affecting it, Illumination required for various work planes, Space to mounting height ratio, Types of fixtures and relative terms used for interior illumination, Calculation of wattage of each lamp and no of lamps needed, Layout of lamp luminaries, Calculation of space to mounting height ratio, Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building.   |   |                |           |
| <b>Unit - IV</b>   | <b>Design of Outdoor Lighting:</b>  | <b>Periods</b> | <b>9</b>  |
| Street Lighting : Types of street and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaries, Calculation of their wattage, Number and arrangement, Calculation of space to mounting height ratio, Calculation of illumination level available on road .Flood Lighting Types of fixtures and their suitable applications, Selection of lamp and projector, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio   |   |                |           |
| <b>Unit – V</b>  | <b>Renewable Energy based Lighting System</b>   | <b>Periods</b> | <b>9</b>  |
| Different Renewable Sources of Energy - Solar, Wind, Tidal, Biomass, Geo thermal, fuel cell, human - powered etc - Its Principles & Technical Description, Induction Generator Principle, Charging methods from different sources – Storage Battery Technologies, Charge control techniques, Principles of inverter, dc to dc converter, Load management - energy efficient discharge lamp and different types of electronic ballasts, LED lamps & its drivers, Wiring & Fittings, Lightning Protection, Installing, Managing, Maintaining& Servicing off-grid systems, Sustainability & Building Design & Lighting, Integration of different sources of Energy, Inter connection of Renewable Energy Sources with the grid. |   |                |           |
| <b>Total Periods</b>   |   |                | <b>45</b> |
| <b>Text Books</b>  |   |                |           |
| 1.   | Gupta J. B., “Utilization of Electric Power & Electric Traction” S. K. Kataria& Sons, 2nd edition, 2012.                          |                |           |
| 2.   | Uppal S. L, “Electrical Power”, Khanna Book Publication, 13th edition, 1988.  |                |           |
| 3.   | Partab H. P., “Art & Science of Utilization of Electrical Engineering”, Dhanpat Rai Publications, 2017                            |                |           |
| <b>References</b>  |   |                |           |
| 1.   | Jack L. Lindsey, “Applied Illumination Engineering”, Fairmont Pr; 2nd edition, 1996.  |                |           |
| 2.   | John Matthews, “Introduction to the Design and Analysis of Building Electrical Systems”, Springer Science & Business Media, 1993. |                |           |
| 3.   | M.A. Cayless, “Lamps and Lighting”, Routledge; 4th edition, 2012.   |                |           |
| 4.   | Integration of Alternative Sources of Energy – F.A. Farret, M. G. Simoes, IEEE Press  |                |           |
| 5.   | O. E. Taylor, “Utilization of Electrical Energy”, Longman, 1971.  |                |           |

**E-Resources**

|    |   |
|----|---|
| 1. | <a href="#">Microsoft PowerPoint - L23 Lighting intro.ppt (colorado.edu)</a>                                |
| 2. | <a href="#">Ch-08_gopsons.qxd (beeindia.gov.in)</a>   |
| 3. | <a href="#">Energy efficiency in electrical system (slideshare.net)</a>                                     |
| 4. | <a href="#">Illumination. (slideshare.net)</a>  |
| 5. | <a href="#">What is Energy Efficient Lighting and Techniques to Implement It (electricaltechnology.org)</a> |





**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
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Elayampalayam, Tiruchengode – 637 205



|  |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
|--|---|------------------|-------------|-------------|-------------|---------------|-------------|-----------------|-------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b>  | Regulation  | <b>2019</b> |               |             |                 |             |              |              |              |                       |              |              |              |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |             | Semester    |             |               |             |                 |             |              |              |              |                       |              |              |              |
| Course Code  | Course Name   | Periods Per Week |             |             | Credit      | Maximum Marks |             |                 |             |              |              |              |                       |              |              |              |
|  |   | L                | T           | P           |             | C             | CA          | ESE             | Total       |              |              |              |                       |              |              |              |
| <b>U19EEOE7</b>  | <b>Soft computing Techniques</b>  | 3                | 0           | 0           | 3           | 40            | 60          | 100             |             |              |              |              |                       |              |              |              |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>• Understand the concepts of Artificial Neural Network</li> <li>• Understand the Fuzzy logic and Genetic algorithms.</li> <li>• Understand the Hybrid systems</li> </ul> |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>Course Outcome</b>  | <b>On completion of the course the students will be able to</b>   |                  |             |             |             |               |             | Knowledge Level |             |              |              |              |                       |              |              |              |
|  | <b>CO1:</b> Recognize neural networks to build intelligent systems.   |                  |             |             |             |               |             | K2              |             |              |              |              |                       |              |              |              |
|  | <b>CO2:</b> Apply neural networks to solve classification and regression Problems.  |                  |             |             |             |               |             | K3              |             |              |              |              |                       |              |              |              |
|  | <b>CO3:</b> Apply fuzzy principles to deal with vulnerability and tackle real time issues.  |                  |             |             |             |               |             | K3              |             |              |              |              |                       |              |              |              |
|  | <b>CO4:</b> Apply genetic algorithms to obtain optimized results for a particular problem.  |                  |             |             |             |               |             | K3              |             |              |              |              |                       |              |              |              |
| <b>CO5:</b> Apply advanced genetic operators and genetic programming to solve real world problems  |   |                  |             |             |             |               | K3          |                 |             |              |              |              |                       |              |              |              |
| <b>Pre-requisites</b>  |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak |   |                  |             |             |             |               |             |                 |             |              |              |              | <b>CO/PSO Mapping</b> |              |              |              |
| <b>COs</b>   | <b>Programme Outcomes (POs)</b>   |                  |             |             |             |               |             |                 |             |              |              |              | <b>PSOs</b>           |              |              |              |
|  | <b>PO 1</b>   | <b>PO 2</b>      | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b>   | <b>PO 7</b> | <b>PO 8</b>     | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PO 12</b> | <b>PSO 1</b>          | <b>PSO 2</b> | <b>PSO 3</b> | <b>PSO 4</b> |
| <b>CO 1</b>  | 3   | 3                | 3           |             | 1           |               |             |                 |             |              | 2            | 2            | 2                     | 1            | 2            | 1            |
| <b>CO 2</b>  | 3   | 3                | 3           |             | 2           |               |             |                 |             |              | 2            | 2            | 2                     | 1            | 2            | 1            |
| <b>CO 3</b>  | 3   | 3                | 3           |             | 2           |               |             |                 |             |              | 2            | 3            | 2                     | 1            | 2            | 1            |
| <b>CO 4</b>  | 3   | 3                | 3           |             | 1           |               |             |                 |             |              | 2            | 3            | 2                     | 1            | 2            | 1            |
| <b>CO 5</b>  | 3   | 3                | 3           |             | 1           |               |             |                 |             |              | 2            | 3            | 2                     | 1            | 2            | 1            |
| <b>Course Assessment Methods</b>   |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>Direct</b>  |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations         |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
| <b>Indirect</b>  |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |
| 1. Course – end survey   |   |                  |             |             |             |               |             |                 |             |              |              |              |                       |              |              |              |

| <b>Content of the syllabus</b>  |   |         |           |
|---|---|---------|-----------|
| <b>Unit – I</b>   | <b>ARTIFICIAL NEURAL NETWORKS -I</b>  | Periods | <b>9</b>  |
| Introduction to Soft computing – Neural Networks – Model – activation functions – types of architecture. Supervised learning: Architecture and algorithm - Perceptrons – Adaline and Madaline – Back propagation algorithm – Radial Basis Function Networks   |   |         |           |
| <b>Unit - II</b>  | <b>ARTIFICIAL NEURAL NETWORKS-II</b>  | Periods | <b>9</b>  |
| Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self Organizing Networks – Learning Vector Quantization – Hebbian Learning – Simulated annealing – Boltzman machine – Deep neural networks.   |   |         |           |
| <b>Unit – III</b>   | <b>FUZZY LOGIC</b>  | Periods | <b>9</b>  |
| Introduction to Fuzzy Logic - Classical Sets and Fuzzy Sets - Fuzzy Relations- Membership functions – Fuzzification – Defuzzification - Fuzzy if-then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models –Sugeno Fuzzy Models –Tsukamoto Fuzzy Models – Input Space Partitioning - Fuzzy Modelling. |   |         |           |
| <b>Unit - IV</b>  | <b>GENETIC ALGORITHM</b>  | Periods | <b>9</b>  |
| Simple genetic algorithm – Operators of Genetic Algorithm(GA): Encoding- selection – crossover – mutation.Stopping conditionofGA–Problem solving using genetic algorithm–Schema theorem-Real coded genetic algorithm - Advantages and limitations – Applications of GA.   |   |         |           |
| <b>Unit – V</b>   | <b>HYBRID SYSTEMS</b>   | Periods | <b>9</b>  |
| Advanced Operators and Techniques in Genetic Algorithm- Parallel and Distributed Genetic Algorithm - Hybrid Genetic Algorithm (HGA) – Adaptive Genetic Algorithm – Fast Messy Genetic Algorithm - Independent Sampling Genetic Algorithm - Genetic Programming- Applications  |   |         |           |
| <b>Total Periods</b>  |   |         | <b>45</b> |
| <b>Text Books</b>   |   |         |           |
| 1.  | S.N. Sivanandam,S.N. Deepa, “Principles of soft computing” Wiley India Pvt Ltd. 3 <sup>rd</sup> Edition, New Delhi,2018   |         |           |
| 2.  | Yegnanarayana, “Artificial Neural Networks” PHI learning Pvt Ltd, Eastern economy New Delhi, 2012   |         |           |
| <b>References</b>   |   |         |           |
| 1.  | Zimmermann H.J. “Fuzzy set theory and its Applications” Springer international edition, 2011.   |         |           |
| 2.  | James A Freeman and David M.Skapra, Neural Networks: Algorithms, Applications, and Programming Techniques, Addison-Wesley, 1991, Digital Version 2007..                     |         |           |
| 3.  | S.N. Sivanandam S.N. Deepa, “Introduction to Genetic Algorithms”,Springer-Verlag, Berlin Heidelberg ,2008   |         |           |
| <b>E-Resources</b>  |   |         |           |
| 1.  | <a href="https://www.sciencedirect.com/topics/computer-science/soft-computing-technique">https://www.sciencedirect.com/topics/computer-science/soft-computing-technique</a> |         |           |
| 2.  | <a href="https://nptel.ac.in/courses/117/105/117105084/">https://nptel.ac.in/courses/117/105/117105084/</a>   |         |           |
| 3.  | <a href="https://freevideolectures.com/course/4565/nptel-introduction-soft-computing/40">https://freevideolectures.com/course/4565/nptel-introduction-soft-computing/40</a> |         |           |
| 4.  | <a href="https://www.digimat.in/nptel/courses/video/106105173/L01.html">https://www.digimat.in/nptel/courses/video/106105173/L01.html</a>                                   |         |           |

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|--|---|------------------|------|------|------------|---------------|-------------|---|-----------------|-------|-------|-------|----------------|-------|-------|-------|
| Programme  | <b>B.E.</b>   | Programme Code   |      |      | <b>102</b> | Regulation    | <b>2019</b> |   |                 |       |       |       |                |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |      |      |            | Semester      |             |   |                 |       |       |       |                |       |       |       |
| Course Code  | Course Name   | Periods Per Week |      |      | Credit     | Maximum Marks |             |   |                 |       |       |       |                |       |       |       |
|  |   | L                | T    | P    |            | C             | CA          | ESE   | Total           |       |       |       |                |       |       |       |
| <b>U19EEOE8</b>  | <b>Electrical Systems in Industry</b>   | 3                | 0    | 0    | 3          | 40            | 60          | 100   |                 |       |       |       |                |       |       |       |
| Course Objective   | The students should made to <ul style="list-style-type: none"> <li>To provide in-depth understanding of Electrical System Components, Residential and Commercial Electrical Systems, Industrial Electrical Systems:</li> <li>HT connection, industrial substation, Transformer selection, Role of Engineer in automation, advantages of process automation</li> </ul> |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| Course Outcome   | At the end of the course, the student should be able to,  |                  |      |      |            |               |             |   | Knowledge Level |       |       |       |                |       |       |       |
|  | <b>CO1:</b> Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.  |                  |      |      |            |               |             |   | K2              |       |       |       |                |       |       |       |
|  | <b>CO2:</b> Understand various terms regarding light, lumen, intensity, candle power, lamp efficiency, and specific consumption.  |                  |      |      |            |               |             |   | K2              |       |       |       |                |       |       |       |
|  | <b>CO3:</b> Understand various components of industrial electrical systems, Industrial loads, Switchgear selection  |                  |      |      |            |               |             |   | K2              |       |       |       |                |       |       |       |
|  | <b>CO4:</b> Analyze and select the proper size of Transformer.  |                  |      |      |            |               |             |   | K3              |       |       |       |                |       |       |       |
|  | <b>CO5:</b> Understand Role of in automation, PLC based control system design, Panel Metering   |                  |      |      |            |               |             |   | K2              |       |       |       |                |       |       |       |
| Pre-requisites   | Basic concepts and understanding of industrial systems  |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| CO / PO Mapping  |   |                  |      |      |            |               |             |   |                 |       |       |       | CO/PSO Mapping |       |       |       |
| (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak                   |   |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| COs  | Programme Outcomes (POs)  |                  |      |      |            |               |             |   |                 |       |       |       | PSOs           |       |       |       |
|  | PO 1  | PO 2             | PO 3 | PO 4 | PO 5       | PO 6          | PO 7        | PO 8  | PO 9            | PO 10 | PO 11 | PO 12 | PSO 1          | PSO 2 | PSO 3 | PSO 4 |
| <b>CO 1</b>  | 3   | 1                | 2    | -    | 2          | -             | -           | -   | -               | -     | -     | 2     | 3              | -     | -     | -     |
| <b>CO 2</b>  | 3   | 1                | 2    | -    | 2          | -             | -           | -   | -               | -     | -     | 2     | 3              | -     | -     | -     |
| <b>CO 3</b>  | 3   | 1                | 2    | -    | 2          | -             | -           | -   | -               | -     | -     | 2     | 3              | -     | -     | -     |
| <b>CO 4</b>  | 3   | 1                | 2    | -    | 2          | -             | -           | -   | -               | -     | -     | 2     | 3              | -     | -     | -     |
| <b>CO 5</b>  | 3   | 1                | 2    | -    | 2          | -             | -           | -   | -               | -     | -     | 2     | 3              | -     | -     | -     |
| Course Assessment Methods  |   |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| Direct   |   |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| 1. Continuous Assessment Test I, II & III<br>2. Assignment<br>3. End-Semester examinations |   |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| Indirect   |   |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |
| 1. Course - end Survey   |   |                  |      |      |            |               |             |   |                 |       |       |       |                |       |       |       |

| <b>Content of the syllabus</b>  |   |                |           |
|---|---|----------------|-----------|
| <b>Unit – I</b>   | <b>Electrical System Components</b>   | <b>Periods</b> | <b>9</b>  |
| LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.  |   |                |           |
| <b>Unit - II</b>  | <b>Residential and Commercial Electrical Systems</b>  | <b>Periods</b> | <b>9</b>  |
| Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.                           |   |                |           |
| <b>Unit – III</b>   | <b>Illumination Systems</b>   | <b>Periods</b> | <b>9</b>  |
| Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting |   |                |           |
| <b>Unit - IV</b>  | <b>Industrial Electrical Systems</b>  | <b>Periods</b> | <b>9</b>  |
| HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.  |   |                |           |
| <b>Unit – V</b>   | <b>Industrial Electrical System Automation</b>  | <b>Periods</b> | <b>9</b>  |
| Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation   |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1.  | S. L. Uppal, G. C. Garg, “Electrical Wiring, Estimating & costing”, Khanna publishers, 6th edition, 2008.   |                |           |
| <b>References</b>   |   |                |           |
| 1.  | K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 1st edition, 2007.           |                |           |
| 2.  | S. Singh, R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 2nd edition, 2010.         |                |           |
| 3.  | J. B. Gupta, “Utilization of Electric Power & Electric Traction”, S.K. Kataria& Sons, 2nd edition, 2014.    |                |           |
| 4.  | H. Joshi, “Residential Commercial and Industrial Systems”, Volume I, McGraw Hill Education, 2008.           |                |           |
| <b>E-Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses/108/104/108104051/">https://nptel.ac.in/courses/108/104/108104051/</a> |                |           |
| 2.  | <a href="https://nptel.ac.in/courses/108/105/108105063/">https://nptel.ac.in/courses/108/105/108105063/</a> |                |           |
| 3.  | <a href="https://nptel.ac.in/courses/108/105/108105064/">https://nptel.ac.in/courses/108/105/108105064/</a> |                |           |





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|  |   |                  |            |            |             |               |     |                        |
|--|---|------------------|------------|------------|-------------|---------------|-----|------------------------|
| Programme  | <b>B.E.</b>   | Programme Code   | <b>102</b> | Regulation | <b>2019</b> |               |     |                        |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |            | Semester   | <b>VII</b>  |               |     |                        |
| Course Code  | Course Name   | Periods Per Week |            |            | Credit      | Maximum Marks |     |                        |
|  |   | L                | T          | P          | C           | CA            | ESE | Total                  |
| <b>U19MCFY7</b>  | <b>Comprehension on Electricity-Theory and Practice I</b>   | 3                | 0          | 0          | 0           | 100           | 0   | 100                    |
| <b>Course Objective</b>                                      | The students should made to <ul style="list-style-type: none"> <li>• Learn the basic concepts of electrical property and electrical machines</li> <li>• Learn the basics about Generation and Transmission</li> <li>• Learn the basics of Power quality issues</li> </ul> |                  |            |            |             |               |     |                        |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |            |            |             |               |     | <b>Knowledge Level</b> |
|  | <b>CO1:Understand the basics of Electrical property</b>   |                  |            |            |             |               |     | K2                     |
|  | <b>CO2:Interpret the Generation of Power from different sources</b>   |                  |            |            |             |               |     | K2                     |
|  | <b>CO3:Classify the basics of Transmission System</b>   |                  |            |            |             |               |     | K2                     |
|  | <b>CO4: Construct the Earthing System</b>   |                  |            |            |             |               |     | K3                     |
| <b>CO5:Summarizethe Power Quality issues and regulations</b> |   |                  |            |            |             |               | K2  |                        |
| <b>Pre-requisites</b>  | Fundamental Knowledge of Electricity and Electrical Power Systems   |                  |            |            |             |               |     |                        |

| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1– Weak |                          |      |      |      |      |      |      |      |      |       |       |       | <b>CO/PSO Mapping</b> |       |       |       |
|---|--------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|-------|
| Cos   | Programme Outcomes (POs) |      |      |      |      |      |      |      |      |       |       |       | PSOs                  |       |       |       |
|   | PO 1                     | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 | PSO 4 |
| CO 1  | 3                        | 2    |      |      |      |      |      |      |      |       |       | 3     | 3                     |       | 2     |       |
| CO 2  | 3                        | 2    |      |      |      |      |      |      |      |       |       | 3     | 3                     |       | 2     |       |
| CO 3  | 3                        |      |      |      |      |      |      |      |      |       |       | 3     | 3                     |       | 3     |       |
| CO 4  | 3                        | 2    |      |      |      |      |      |      |      |       |       | 3     | 3                     |       | 2     |       |
| CO 5  | 3                        | 2    |      |      |      |      |      |      |      |       |       | 3     | 3                     |       | 2     |       |

**Course Assessment Methods**



**Direct**

- 1.Continuous Assessment Test I, II & III
- 2.Assignment

**Indirect**

1. Course-end Survey

| <b>Content of the Syllabus</b>   |   |         |           |
|--|---|---------|-----------|
| <b>Unit – I</b>  | <b>ELECTRICAL PROPERTY</b>  | Periods | <b>9</b>  |
| Atomic structure - electrons properties - electrostatic field - electric current- magnetism, electromagnetic wave and chemical reaction between elements<br><b>Electrical Property:</b><br>Conductor-metals - silver, copper, aluminum- voltage, current and resistance relationship-ohms law for dc and ac - specific resistance of metals-resistance based on physical dimensions of conductor- resistance variation by temperature rise due to joulean heat and atmospheric temperature and temperature coefficient of metal- free electrons in conductors- current carrying capacity based on free electrons available - velocity of current and energy propagation - current carrying capacity limitation by temperature rise in conductors-current in conductor, semiconductor, insulator, liquid and gas.<br>Semiconductors- silicon, germanium- doping- various characteristics of diode and uses - SCR types - use in converter stations of HVDC.<br>Insulators – insulation analogous to river banks -various type of insulators – polymers – types -leakage current<br>Magnetism - natural magnet - manmade magnets - magnetic property of metals- iron, steel-electromagnet – permanent and temporary magnet - magnetic field; steady - changing/ varying field. Electromagnetic field and induction – DC generator – alternator - transformer |   |         |           |
| <b>Unit – II</b>   | <b>GENERATION OF POWER</b>  | Periods | <b>9</b>  |
| AC Generation -fuel based- water, steam, wind turbines - turbine types - nuclear – artificial acceleration of fission of uranium nucelli, mass defect – proof for $E= mc^2$ - Indian scenario on nuclear power stations.<br>DC generation-solar photovoltaic cell, fuel cell- Battery-lead acid, lithium ion - generation of AC emf magnitudes - DC cell voltage - inversion of DC to AC generated emf - induced emf - need for stepping up generated emf to EHV level - role of transformer.  |   |         |           |
| <b>Unit – III</b>  | <b>TRANSMISSION SYSTEM</b>  | Periods | <b>9</b>  |
| AC Transmission - sub-transmission and distribution voltages - HVDC transmission -types – voltages – advantages – Underground cables - EHV sub- station - Types- equipments – functions. Protection and control - signaling and monitoring in sub-station.<br>Solid, stranded and hollow conductors-stranded conductor types and sizes- current carrying capacity, voltage regulation methods and limits -Ferranti effect- corona  |   |         |           |
| <b>Unit – IV</b>   | <b>EARTHING SYSTEM</b>  | Periods | <b>9</b>  |
| Earthing and grounding - purpose of earthing - earth as conductor - guarding under electrical lines - types of earthing - transient ground potential rise, touch, step, and transfer potential - earth electrode resistance - soil resistivity - measurement of resistance of earth connection - limits - lowering the earth connection resistance within limits - measurement of soil resistivity - earthing systems TNC, TNC-S   |   |         |           |
| <b>Unit – V</b>  | <b>POWER QUALITY</b>  | Periods | <b>9</b>  |
| Power quality definition - power quality deficiencies - current and voltage harmonics (pollutant to electricity) and their effects, current harmonic control and limits as per CEA(Central Electricity Authority - New Delhi) and TNERC (Tamilnadu Electricity Regulatory Commission ) regulations in consumer non-linear loads, generation resources of wind mills, solar photovoltaic and electric charging stations, effects of current harmonics.  |   |         |           |
| <b>Total Periods</b>   |   |         | <b>45</b> |
| <b>Text Books</b>  |   |         |           |
|  | D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, 2016. |         |           |
|  | S.Kandasamy, Electricity Theory and Practice, Amity University Press, New Delhi,2021              |         |           |
| <b>References</b>  |   |         |           |
| 1.   | β. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016        |         |           |
| 2.   | ttle,Mittal, Basic Electrical Engineering, 2nd Edition, Tata McGraw-Hill Edition, 2016.           |         |           |
| 3.   | S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015.                                       |         |           |
| <b>E-Resources</b>   |   |         |           |
| 1.   | <a href="https://nptel.ac.in/courses">https://nptel.ac.in/courses</a>                             |         |           |

|  |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
|--|---|------------------|------|------|--------|---------------|------------|---|------------------------|-------|-------|-----------------------|----------|-------|-------|-------|
|   | <b>VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN</b><br>(Autonomous Institution, Affiliated to Anna University, Chennai)<br>Elayampalayam, Tiruchengode – 637 205   |                  |      |      |        |               |            |  |                        |       |       |                       |          |       |       |       |
| Programme  | <b>B.E.</b>   | Programme Code   |      |      |        | <b>102</b>    | Regulation | <b>2019</b>   |                        |       |       |                       |          |       |       |       |
| Department   | <b>ELECTRICAL AND ELECTRONICS ENGINEERING</b>   |                  |      |      |        | Semester      |            | <b>VIII</b>   |                        |       |       |                       |          |       |       |       |
| Course Code  | Course Name   | Periods Per Week |      |      | Credit | Maximum Marks |            |   |                        |       |       |                       |          |       |       |       |
|  |   | L                | T    | P    | C      | CA            | ESE        | Total   |                        |       |       |                       |          |       |       |       |
| <b>U19MCFY8</b>  | <b>Comprehension on Electricity-Theory and Practice-II</b>  | 3                | 0    | 0    | 0      | 100           | 0          | 100   |                        |       |       |                       |          |       |       |       |
| <b>Course Objective</b>  | The students should made to <ul style="list-style-type: none"> <li>• Learn the protection and safety on electrical installations and lighting</li> <li>• Learn the different types of traction and lighting schemes</li> <li>• Learn the metering and tariff and IE act related to the consumers</li> </ul> |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| <b>Course Outcome</b>  | At the end of the course, the student should be able to,  |                  |      |      |        |               |            |   | <b>Knowledge Level</b> |       |       |                       |          |       |       |       |
|  | <b>CO1:</b> Understand the protection and safety of electrical installations  |                  |      |      |        |               |            |   | K2                     |       |       |                       |          |       |       |       |
|  | <b>CO2:</b> Summarize the lightning protection schemes  |                  |      |      |        |               |            |   | K2                     |       |       |                       |          |       |       |       |
|  | <b>CO3:</b> Explain the traction and different lighting schemes   |                  |      |      |        |               |            |   | K2                     |       |       |                       |          |       |       |       |
|  | <b>CO4:</b> Illustrate energy conservation, metering and tariff   |                  |      |      |        |               |            |   | K2                     |       |       |                       |          |       |       |       |
| <b>CO5:</b> Summarize the power system communication and IE acts related to consumers  |   |                  |      |      |        |               |            | K2  |                        |       |       |                       |          |       |       |       |
| <b>Pre-requisites</b>  | Fundamental Knowledge of Electricity and Electrical Power Systems   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| <b>CO / PO Mapping</b><br>(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak   |   |                  |      |      |        |               |            |   |                        |       |       | <b>CO/PSO Mapping</b> |          |       |       |       |
| <b>Cos</b>   | Programme Outcomes (POs)  |                  |      |      |        |               |            |   |                        |       |       |                       | PSOs     |       |       |       |
|  | PO 1  | PO 2             | PO 3 | PO 4 | PO 5   | PO 6          | PO 7       | PO 8  | PO 9                   | PO 10 | PO 11 | PO 12                 | PSO 1    | PSO 2 | PSO 3 | PSO 4 |
| <b>CO 1</b>  | 3   | 2                |      |      |        |               |            |   |                        |       |       | 3                     | 3        |       | 2     |       |
| <b>CO 2</b>  | 3   | 2                |      |      |        |               |            |   |                        |       |       | 3                     | 3        |       | 2     |       |
| <b>CO 3</b>  | 3   |                  |      |      |        |               |            |   |                        |       |       | 3                     | 3        |       | 3     |       |
| <b>CO 4</b>  | 3   | 2                |      |      |        |               |            |   |                        |       |       | 3                     | 3        |       | 2     |       |
| <b>CO 5</b>  | 3   | 2                |      |      |        |               |            |   |                        |       |       | 3                     | 3        |       | 2     |       |
| <b>Course Assessment Methods</b>   |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| <b>Direct</b>  |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| 1.Continuous Assessment Test I, II & III   |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| 2 .Assignment  |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| <b>Indirect</b>  |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| 1.Course – End Survey  |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| <b>Content of the Syllabus</b>   |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |
| <b>Unit – I</b>  | <b>PROTECTION AND SAFETY IN LOW VOLTAGE INSTALLATIONS</b>   |                  |      |      |        |               |            |   |                        |       |       | <b>Periods</b>        | <b>9</b> |       |       |       |
| Deficiency in protecting installations, equipment and human beings in domestic, commercial, industrial, agricultural services - abnormal conditions - over loading (equipment and installation), short circuit, earth fault and earth leakage- various protective schemes- rewirable fuses, HRC fuses, MCB/MCCB, RCD/RCCB - CEA and TNERC mandatory provision to have electrical accident - free installations/premises. |   |                  |      |      |        |               |            |   |                        |       |       |                       |          |       |       |       |

| <b>Unit – II</b>  | <b>LIGHTNING PROTECTION</b>   | <b>Periods</b> | <b>9</b>  |
|---|---|----------------|-----------|
| Lightning phenomena, direct and indirect strokes on transmission lines, direct stroke on power stations and sub-stations, direct stroke on temple towers, high rise buildings, communication towers - protective devices - passive systems- Franklin rod, faraday cage, active attractive air terminal system - its components - air terminal, Down conductor , effectively earthed system, lightning event counter - advantages of active system - ground potential equalization with transient earth clamps   |   |                |           |
| <b>Unit – III</b>   | <b>UTILIZATION OF ELECTRICAL ENERGY</b>   | <b>Periods</b> | <b>9</b>  |
| Electrical drive - DC motors -types – applications, comparison among various dc and ac motors, railway traction - diesel-electric locomotive - electric locomotive - magnetic levitation trains. Illumination-sensitivity of the eye - sources of light - requirement of good lighting - shadows, glare, colour rendering-light sources, comparison of lamps- future light LED, LASER light and uses.   |   |                |           |
| <b>Unit – IV</b>  | <b>ENERGY CONSERVATION</b>  | <b>Periods</b> | <b>6</b>  |
| Need for energy conservation - Energy conservation ACT 2001- bureau of energy efficiency - energy audit - star rating of equipment - energy conservation methods - line loss reduction, higher efficiency of transformers - reactive power management - reactive power compensation by capacitors - lines, motors, transformers- field study.   |   |                |           |
| <b>Unit – V</b>   | <b>METERING, TARIFF AND POWER SYSTEM COMMUNICATION</b>  | <b>Periods</b> | <b>6</b>  |
| Category of consumers - metering arrangements in a nutshell- tariff-two-part tariff - penalty for poor power factor - penalty for exceeding harmonic limit - billing in kVAhr.<br>Communication in the past - present communication systems - telegraph, telephone, radio, television, RADAR, space communication, VHF, Global telecommunication - power system communication, power line carrier for medium and long distances, carrier, multipurpose carrier set, modulation - amplitude modulation, frequency modulation, frequency shift, power line carrier equipment, line/wave trap, coupling capacitor, line matching unit, supervisory facilities, SCADA, carrier relay trip - radio links for short distances - load-frequency control - mobile carrier sets.   |   |                |           |
| <b>Unit – VI</b>  | <b>ACTS, RULES AND REGULATIONS RELATING TO CONSUMERS</b>  | <b>Periods</b> | <b>6</b>  |
| <b>IE ACT 2003 , CEA ,TAMILNADU ELECTRICITY SUPPLY CODE AND DISTRIBUTION CODE</b><br>Sections 42-establish forum for redressal of grievances of the consumers' read with Rules 5 and 7 of Electricity rules 2005 and TNERC Regulations for consumer grievance redressal forum and electricity Ombudsman 2004 - 55-consumer meter read with CEA (Installation and operation of meters) Regulations 2006 - 56-disconnection of supply in default of payment - 57-standards of performance of licensee-126 - unauthorized use of electricity - 135-theft of electricity -138-interference with meters – 142 and 146-punishment for non-compliance of provisions of ACT/rules/regulations – 145 civil court not to have jurisdiction -152 compounding of offences -171- read with means of delivery of notice, orders or document rules 2004. |   |                |           |
| <b>Total Periods</b>  |   |                | <b>45</b> |
| <b>Text Books</b>   |   |                |           |
| 1   | H.Partab, Art and Science of Utilization of Electrical Energy, Dhanpat Rai and Co., New Delhi,2019.         |                |           |
| 2   | S.Kandasamy, Electricity Theory and Practice, Amity University Press, New Delhi,2021                        |                |           |
| 3   | Uppal and S.Rao, Electrical Power Systems, Khanna Publishers, New Delhi, 2018.                              |                |           |
| <b>References</b>   |   |                |           |
| 1.  | Gupta, Utilization of Electrical Energy, Kataria Publications, Ludhiana, 2019.                              |                |           |
| 2.  | .Wadhwa, Generation, Distribution and Utilization of Electrical Power, Wiley Eastern Ltd., New Delhi, 2019. |                |           |
| 3   | Indian Electricity Rules 1956 by Government of India, 2018  |                |           |
| <b>Resources</b>  |   |                |           |
| 1.  | <a href="https://nptel.ac.in/courses">https://nptel.ac.in/courses</a>                                       |                |           |