VIVEKANANDHA

COLLEGE OF ENGINEERING FOR WOMEN

(An Autonomous Institution Affiliated to Anna University - Chennai

Approved by AICTE - Accredited by NBA New Delhi and ISO 9001:2008 Certified)

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

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULA & SYLLABI

REGULATION 2019

(After 14th BoS)

Curriculum and Syllabus (1 to 8 Semester)

(Applicable to the students admitted from the academic year 2021 – 2022 onwards)

CHOICE BASED CREDIT SYSTEM

[CBCS]

Signature of BOS Chairman ECE

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

- To Produce Innovative, Creative, Ethical and Socially responsible Electronics and Communication women engineers to meet the global challenges

DEPARTMENT MISSION

- To create a unique learning environment in Electronics and Communication Engineering to mould a strong engineer with professional ethics
- To provide practical exposure to compete in the global market
- Fostering culture of innovation, research and lifelong learning

Signature of BOS Chairman ECE

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation 2019

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To offer strong theoretical and practical knowledge with managerial skills and entrepreneurial competencies.

PEO2: To impart analytic and questioning skills to broaden innovative ideas for Research and Development based on Industry requirements.

PEO3: To achieve a high level technical expertise in Electronics and Communication Engineering and inculcate professional ethics and social concern

PROGRAM OUTCOMES (POs):

PO 1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. 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.

PO 4. 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.

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PO 5. 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.

PO 6. 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.

PO 7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10. 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.

PO 11. 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.

PO 12. 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.

PROGRAM SPECIFIC OUTCOMES (PSOs):

At the end of this program, graduate will be able to:

PSO 1: Comprehend the basic concepts of electronics and communication and apply in the day to day life to design and execute complete engineering systems.

PSO2: Design, verify and validate electronic functional elements for numerous applications including signal processing, communications, computer networks and VLSI.

PSO 3: Demonstrate the intellectual level with peer engineers and others to work together to arrive at a cost-effective, appropriate solution for various problems.

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MAPPING OF PROGRAM EDUCATIONAL OBJECTIVES WITH PROGRAM OUTCOMES:

PROGRAM EDUCATIONAL OBJECTIVES	PROGRAM OUTCOMES											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PEO 1	✓	✓	✓	✓	✓	✓				✓	✓	
PEO 2	✓	✓	✓	✓		✓	✓			✓		
PEO 3				✓		✓		✓	✓		✓	✓

Sem	Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
I	Calculus	✓	✓	✓			✓						✓
	English for Communication- I						✓	✓	✓	✓	✓	✓	✓
	Engineering Chemistry	✓	✓	✓			✓						✓
	Programming for Problem Solving	✓	✓	✓			✓						✓
	Engineering Graphics	✓	✓	✓			✓						
	Mandatory Course-II												
	Chemistry Laboratory	✓	✓			✓			✓	✓	✓		
	Computer Practices Laboratory	✓	✓			✓			✓	✓	✓		
II	Linear Algebra and Ordinary Differential Equations	✓	✓	✓			✓						✓
	English for Communication- II						✓	✓	✓	✓	✓	✓	✓
	Engineering Physics	✓	✓	✓			✓						✓
	Basic Civil and Mechanical Engineering	✓	✓	✓				✓	✓				✓
	Basic Electrical and Electronics Engineering	✓	✓	✓			✓						✓
	Electric Circuit Theory	✓	✓	✓			✓						
	□ □ □ □ □ □ □ □ □ □ /Heritage of Tamils[&]												
	Mandatory Course-I												
	Physics Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	Engineering Practices Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
III	Transforms and Partial differential Equations	✓	✓	✓								✓	✓
	Electron Devices	✓	✓	✓			✓						✓
	Electronic Circuits -I	✓	✓	✓								✓	✓
	Digital System Design	✓	✓	✓			✓						✓

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	Signals and Systems	✓	✓	✓			✓						
	Data Structures	✓	✓	✓									✓
	□ /Tamils and Technology&												
	Mandatory Course-III												
	Digital System Design Laboratory	✓	✓			✓				✓	✓	✓	
	Electron Devices and Circuits Laboratory	✓	✓			✓				✓	✓	✓	
	Data Structures Laboratory	✓	✓			✓				✓	✓	✓	
IV	Probability and Random Processes	✓	✓	✓								✓	✓
	Electronic Circuits-II	✓	✓	✓			✓						✓
	Digital Signal Processing	✓	✓	✓			✓						✓
	Electromagnetic Fields	✓	✓	✓			✓						✓
	Linear Integrated Circuits	✓	✓	✓			✓						✓
	Measurements and Instrumentation	✓	✓	✓				✓					
	Mandatory Course-IV												
	Analog and Linear Integrated Circuits Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	Digital Signal Processing Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	Communication Skills Laboratory						✓	✓	✓	✓	✓		✓
V	Control Systems	✓	✓	✓			✓						✓
	Microprocessor and Microcontroller	✓	✓	✓			✓					✓	✓
	Transmission Lines and Waveguides	✓	✓	✓			✓						✓
	Analog and Digital Communication	✓	✓	✓			✓						✓
	Professional Elective -I												
	Open Elective -I												
	Mandatory Course-V												
	Microprocessor and Microcontroller Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	Analog and Digital Communication Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
VI	VLSI Design	✓	✓	✓			✓	✓					✓
	Computer Networks	✓	✓				✓					✓	✓
	Antenna and Wave Propagation	✓	✓	✓			✓						
	Professional Elective-II												
	Open Elective-II												

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	Mandatory Course-VI												
	Computer Networks Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	VLSI Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	Mini Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VII	Principles of Management								✓	✓			✓
	RF and Microwave Engineering	✓	✓	✓	✓		✓						
	Professional Elective-III												
	Professional Elective-IV												
	Professional Elective – V												
	Open Elective-III												
	High Frequency Communication and Simulation Laboratory	✓	✓			✓			✓	✓	✓	✓	✓
	Internship Training and Summer Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VIII	Professional Elective – VI												
	Open Elective - IV												
	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**I**

CURRICULUM

(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
THEORY									
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@	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
PRACTICAL									
U19CH106	Chemistry Laboratory @	BSC	0	0	4	2	60	40	100
U19CS102	Computer Practices Laboratory*	ESC	0	0	4	2	60	40	100
MANDATORY COURSE									
	Mandatory course - II	MC	3	0	0	0	100	--	100
					Total Credits	**20**	**420**	**380**	**800**

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 BOS Chairman ECE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**II**

CURRICULUM

(Applicable to the students admitted from the academic year 2021 – 2022onwards)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
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
U19EE201	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	40	60	100
U19GE202	Basic Civil and Mechanical Engineering *	ESC	3	0	0	3	40	60	100
U19EC201	Electric Circuit Theory	PCC	3	0	0	3	40	60	100
U19TA201	□ □ □ □ □ □ □ □ □ □ □ /Heritage of Tamils &	HSC	2	0	0	1	40	60	40
PRACTICAL									
U19PH208	Physics Laboratory$	BSC	0	0	4	2	60	40	100
U19GE203	Engineering Practices Laboratory *	ESC	0	0	4	2	60	40	100
MANDATORY COURSE									
	Mandatory course - I	MC	3	0	0	0	100	--	100
					Total Credit	**23+1=24**	**500**	**500**	**1000**

CA- Continuous Assessment, ESE - End Semester Examination.

* Common for all branches

$ Common for ECE,EEE,BME

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**III**

CURRICULUM

(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
THEORY									
U19MA303	Transforms and Partial differential Equations*	BSC	3	1	0	4	40	60	100
U19EC302	Electron Devices	PCC	3	0	0	3	40	60	100
U19EC303	Electronic Circuits-I	PCC	3	0	0	3	40	60	100
U19EC304	Digital System Design	PCC	3	0	0	3	40	60	100
U19EC305	Signals and Systems	PCC	3	0	0	3	40	60	100
U19CS304	Data Structures	ESC	3	0	0	3	40	60	100
U19TA302	தமிழரும்தொழில்நுட்பமும்/Tamils and Technology &	HSC	2	0	0	1	40	60	100
PRACTICAL									
U19EC306	Digital System Design Laboratory	PCC	0	0	2	1	60	40	100
U19EC307	Electron Devices and Circuits Laboratory	PCC	0	0	2	1	60	40	100
U19CS308	Data Structures Laboratory	ESC	0	0	4	2	60	40	100
MANDATORY COURSE									
	Mandatory Course-III	MC	3	0	0	0	100	--	100
					Total Credits	**23+1=24**	**520**	**480**	**1000**

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

* Common Syllabus for ECE, EEE &BT

Signature of BOS Chairman ECE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**IV**

CURRICULUM

(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
THEORY									
U19MA407	Probability and Random Processes	BSC	3	1	0	4	40	60	100
U19EC410	Electronic Circuits-II	PCC	3	0	0	3	40	60	100
U19EC411	Digital Signal Processing *	PCC	3	1	0	4	40	60	100
U19EC412	Electromagnetic Fields	PCC	3	0	0	3	40	60	100
U19EC413	Linear Integrated Circuits	PCC	3	0	0	3	40	60	100
U19EC414	Measurements and Instrumentation	PCC	3	0	0	3	40	60	100
PRACTICAL									
U19EC415	Analog and Linear Integrated Circuits Laboratory	PCC	0	0	2	1	60	40	100
U19EC416	Digital Signal Processing Laboratory	PCC	0	0	2	1	60	40	100
U19EN401	Communication Skills Laboratory	HSC	0	0	2	1	100	--	100
MANDATORY COURSE									
	Mandatory Course-IV	MC	3	0	0	0	100	--	100
					Total Credits	**23**	**560**	**440**	**1000**

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

* Common Syllabus for ECE & BME

Signature of BOS Chairman ECE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**

CURRICULUM

(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
THEORY									
U19EC518	Control Systems	PCC	3	0	0	3	40	60	100
U19EC519	Microprocessor and Microcontroller	PCC	3	0	0	3	40	60	100
U19EC520	Transmission Lines and Waveguides	PCC	3	0	0	3	40	60	100
U19EC521	Analog and Digital Communication *	PCC	3	1	0	4	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
PRACTICAL									
U19EC522	Microprocessor and Microcontroller Laboratory	PCC	0	0	2	1	60	40	100
U19EC523	Analog and Digital Communication Laboratory	PCC	0	0	2	1	60	40	100
MANDATORY COURSE									
	Mandatory Course-V	MC	3	0	0	0	100	--	100
					Total Credits	**21**	**460**	**440**	**900**

CA - Continuous Assessment, ESE - End Semester Examination, PCC – Professional Core Courses, PEC - Professional Elective Courses, OEC-Open Elective Courses, MC- Mandatory courses

* Common Syllabus for ECE & BME

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VI**

CURRICULUM

(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
THEORY									
U19EC625	VLSI Design	PCC	3	0	0	3	40	60	100
U19EC626	Computer Networks	PCC	3	0	0	3	40	60	100
U19EC627	Antenna and Wave Propagation	PCC	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
PRACTICAL									
U19EC628	Computer Networks Laboratory	PCC	0	0	2	1	60	40	100
U19EC629	VLSI Laboratory	PCC	0	0	2	1	60	40	100
U19EC630	Mini Project	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
	Mandatory Course-VI	MC	3	0	0	0	100	--	100
					Total Credits	**19**	**520**	**380**	**900**

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

Signature of BOS Chairman ECE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VII**

CURRICULUM

(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
THEORY									
U19BA701	Principles of Management	HSC	3	0	0	3	40	60	100
U19EC731	RF and Microwave Engineering	PCC	3	0	0	3	40	60	100
	Professional Elective-III	PEC	3	0	0	3	40	60	100
	Professional Elective-IV	PEC	3	0	0	3	40	60	100
	Professional Elective – V	PEC	3	0	0	3	40	60	100
	Open Elective-III	OEC	3	0	0	3	40	60	100
PRACTICAL									
U19EC732	High Frequency Communication and Simulation Laboratory	PCC	0	0	2	1	60	40	100
U19EC733	Internship Training and Summer Project	EEC	0	0	4	4	100	-	100
					Total Credits	**23**	**400**	**400**	**800**

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

Signature of BOS Chairman ECE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VIII**

CURRICULUM

(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
THEORY									
	Professional Elective – VI	PEC	3	0	0	3	40	60	100
	Professional Elective – VII	PEC	3	0	0	3	40	60	100
PRACTICAL									
U19EC834	Project Work	EEC	0	0	16	8	60	40	100
					Total Credits	**14**	**140**	**160**	**300**

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

Cumulative Course Credit: **166 (2021-2025 Batch)**

Cumulative Course Credit: **168[&] (2022-2026 Batch)**

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HUMANITIES AND SOCIAL SCIENCE COURSES (HSC)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
U19EN101	English for Communication- I	HSC	3	0	0	3	40	60	100
U19EN202	English for Communication-II	HSC	3	0	0	3	40	60	100
U19EN401	Communication Skills Laboratory	HSC	0	0	2	1	100	--	100
U19BA701	Principles of Management	HSC	3	0	0	3	40	60	100
U19TA201	□ □ □ □ □ □ □ □ □ □/Heritage of Tamils	MC	2	0	0	1	40	60	100
U19TA302	தமிழரும்தொழில்நுட்பமும்/Tamils and Technology	HSC	2	0	0	1	40	60	100

BASIC SCIENCE COURSES (BSC)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
U19MA101	Calculus	BSC	3	1	0	4	40	60	100
U19CH105	Engineering Chemistry	BSC	3	0	0	3	40	60	100
U19CH106	Chemistry Laboratory	BSC	0	0	4	2	60	40	100
U19MA202	Linear Algebra and Ordinary Differential Equations	BSC	3	1	0	4	40	60	100
U19PH207	Engineering Physics	BSC	3	0	0	3	40	60	100
U19PH208	Physics Laboratory	BSC	0	0	4	2	60	40	100
U19MA303	Transforms and Partial differential Equations	BSC	3	1	0	4	40	60	100
U19MA407	Probability and Random Processes	BSC	3	1	0	4	40	60	100

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ENGINEERING SCIENCE COURSES (ESC)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
U19CS101	Programming for Problem Solving	ESC	3	0	0	3	40	60	100
U19GE101	Engineering Graphics	ESC	3	0	0	3	40	60	100
U19CS102	Computer Practices Laboratory	ESC	0	0	4	2	60	40	100
U19GE202	Basic Civil and Mechanical Engineering	ESC	3	0	0	3	40	60	100
U19EE201	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	40	60	100
U19GE203	Engineering Practices Laboratory	ESC	0	0	4	2	60	40	100
U19CS304	Data Structures	ESC	3	0	0	3	40	60	100
U19CS308	Data Structures Laboratory	ESC	0	0	2	1	60	40	100

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
U19EC630	Mini Project	EEC	0	0	4	2	100	-	100
U19EC733	Internship Training and Summer Project	EEC	0	0	4	4	100	-	100
U19EC834	Project Work	EEC	0	0	16	8	100	-	100

PROFESSIONAL CORE COURSES (PCC)

U19EC201	Electric Circuit Theory	PCC	3	0	0	3	40	60	100
U19EC302	Electron Devices	PCC	3	0	0	3	40	60	100
U19EC303	Electronic Circuits-I	PCC	3	0	0	3	40	60	100
U19EC304	Digital System Design	PCC	3	0	0	3	40	60	100
U19EC305	Signals and Systems	PCC	3	0	0	3	40	60	100
U19EC306	Digital System Design Laboratory	PCC	0	0	2	1	60	40	100

Signature of BOS Chairman ECE

U19EC307	Electron Devices and Circuits Laboratory	PCC	0	0	2	1	60	40	100
U19EC410	Electronic Circuits-II	PCC	3	0	0	3	40	60	100
U19EC411	Digital Signal Processing	PCC	3	1	0	4	40	60	100
U19EC412	Electromagnetic Fields	PCC	3	0	0	3	40	60	100
U19EC413	Linear Integrated Circuits	PCC	3	0	0	3	40	60	100
U19EC414	Measurements and Instrumentation	PCC	3	0	0	3	40	60	100
U19EC415	Analog and Linear Integrated Circuits Laboratory	PCC	0	0	2	1	60	40	100
U19EC416	Digital Signal Processing Laboratory	PCC	0	0	2	1	60	40	100
U19EC518	Control Systems	PCC	3	0	0	3	40	60	100
U19EC519	Microprocessor and Microcontroller	PCC	3	0	0	3	40	60	100
U19EC520	Transmission Lines and Waveguides	PCC	3	0	0	3	40	60	100
U19EC521	Analog and Digital Communication	PCC	3	1	0	4	40	60	100
U19EC522	Microprocessor and Microcontroller Laboratory	PCC	0	0	2	1	60	40	100
U19EC523	Analog and Digital Communication Laboratory	PCC	0	0	2	1	60	40	100
U19EC625	VLSI Design	PCC	3	0	0	3	40	60	100
U19EC626	Computer Networks	PCC	3	0	0	3	40	60	100
U19EC627	Antenna and Wave Propagation	PCC	3	0	0	3	40	60	100
U19EC628	Computer Networks Laboratory	PCC	0	0	2	1	60	40	100
U19EC629	VLSI Laboratory	PCC	0	0	2	1	60	40	100
U19EC731	RF and Microwave Engineering	PCC	3	0	0	3	40	60	100
U19EC732	High Frequency Communication and Simulation Laboratory	PCC	0	0	2	1	60	40	100

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MANDATORY COURSES (MC)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
U19MCFY1	Environmental Science and Engineering	MC	3	0	0	0	100	-	100
U19MCFY2	Indian Constitution and Universal Human Values	MC	3	0	0	0	100	-	100
U19MCSY3	Numerical Ability	MC	3	0	0	0	100	-	100
U19MCSY4	Verbal Ability	MC	3	0	0	0	100	-	100
U19MCTY5	Logical Reasoning	MC	3	0	0	0	100	-	100
U19MCTY6	Personality Development	MC	3	0	0	0	100	-	100
U19MCEC4	Online course	MC	3	0	0	0	100	-	100
U19MCEC5	Professional Skills and Practices	MC	3	0	0	0	100	-	100
U19MCEC6	Competencies in Social Skills	MC	3	0	0	0	100	-	100
U19MCEC7	Entrepreneurial Skill Development	MC	3	0	0	0	100	-	100
U19MCEC8	Critical and Creative Thinking Skills	MC	3	0	0	0	100	-	100
U19MCEC9	Business Basics for Entrepreneurs	MC	3	0	0	0	100	-	100
U19MCEC10	Analytical and Logical Thinking Skills	MC	3	0	0	0	100	-	100
U19MCEC11	Entrepreneurship Management	MC	3	0	0	0	100	-	100
U19MCEC12	Value Education	MC	3	0	0	0	100	-	100

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S.No.	VERTICAL COURSES For B.E. ECE Honours (Specialization) / Honours / Minors						
	Vertical I	**Vertical II**	**Vertical III**	**Vertical IV**	**Vertical V**	**Vertical VI**	**Vertical VII**
	Semiconductor and VLSI Design	**Signal Processing**	**Communication System**	**Embedded Systems and Internet of Things (IoT)**	**Networking**	**Artificial Intelligence**	**Electronics Engineering and Administration System**
1	Analog IC Design	Digital Image Processing	Wireless Communication	Embedded System Design and Real Time Applications	Mobile Adhoc Networks	Artificial Intelligence and Machine Learning	Pattern Recognition
2	System-on-Chip Design	Medical Image Processing	Mobile Communication	Sensor For Industrial Application	Wireless Sensor Networks	Deep Learning	Medical Electronics
3	Semiconductor Device Modeling	Biomedical Signal Processing	Optical Communication	ARM System Architecture	Cryptography and Cyber Security	Neural Networks and its Applications	Remote Sensing
4	ASIC Design	Speech and Natural Language Processing	MIMO Communications	Cloud Technologies and its Applications	Communication Switching and Networks	Soft Computing	Automotive Electronics
5	Low Power VLSI Design	Digital Video Processing	Satellite Communication	IoT Processors	Internet Protocol Services	Computer Vision	Industry 4.0
6	Foundations of VLSI CAD	Radar Signal Processing	Green Technology	IoT Enabled Systems Design	Cyber Security	Augmented Reality/ Virtual Reality	Digital Video Processing
7.	Introduction to MEMS	DSP Architecture and Programming	Advanced Radiating Systems	Industrial IoT and Industrial 4.0	Fiber Optic Sensors	Optimization Techniques	Principles of Public Administration
8.	VLSI for Wireless Communication	Software Defined Radio	Rocketry and Space Mechanics	IoT Security and Trust	Optical Networks	Ethics in Artificial Intelligence	Administrative Theories
9.	Online Course	Online Course	Online Course	Online Course	Online Course	Online Course	Indian Administrative System

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS – I SEMICONDUCTOR AND VLSI DESIGN

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV11	Analog IC Design	3	0	0	3	40	60	100
U19ECV12	System-on-Chip Design	3	0	0	3	40	60	100
U19ECV13	Semiconductor Device Modeling	3	0	0	3	40	60	100
U19ECV14	ASIC Design	3	0	0	3	40	60	100
U19ECV15	Low Power VLSI Design	3	0	0	3	40	60	100
U19ECV16	Foundations of VLSI CAD	3	0	0	3	40	60	100
U19ECV17	Introduction to MEMS	3	0	0	3	40	60	100
U19ECV18	VLSI for Wireless Communication	3	0	0	3	40	60	100
U19ECV19	Online Course	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS – II SIGNAL PROCESSING

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV21	Digital Image Processing	3	0	0	3	40	60	100
U19ECV22	Medical Image Processing	3	0	0	3	40	60	100
U19ECV23	Biomedical Signal Processing	3	0	0	3	40	60	100
U19ECV24	Speech and Natural Language Processing	3	0	0	3	40	60	100
U19ECV25	Digital Video Processing	3	0	0	3	40	60	100
U19ECV26	Radar Signal Processing	3	0	0	3	40	60	100
U19ECV27	DSP Architecture and Programming	3	0	0	3	40	60	100
U19ECV28	Software Defined Radio	3	0	0	3	40	60	100
U19ECV29	Online Course	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS – III COMMUNICATION SYSTEM

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV31	Wireless Communication	3	0	0	3	40	60	100
U19ECV32	Mobile Communication	3	0	0	3	40	60	100
U19ECV33	Optical Communication	3	0	0	3	40	60	100
U19ECV34	MIMO Communications	3	0	0	3	40	60	100
U19ECV35	Satellite Communication	3	0	0	3	40	60	100
U19ECV36	Green Technology	3	0	0	3	40	60	100
U19ECV37	Advanced Radiating Systems	3	0	0	3	40	60	100
U19ECV38	Rocketry and Space Mechanics	3	0	0	3	40	60	100
U19ECV39	Online Course	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS-IV EMBEDDED SYSTEMS AND INTERNET OF THINGS (IOT)

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV41	Embedded System Design And Real Time Applications	3	0	0	3	40	60	100
U19ECV42	Sensor For Industrial Application	3	0	0	3	40	60	100
U19ECV43	ARM System Architecture	3	0	0	3	40	60	100
U19ECV44	Cloud Technologies and its Applications	3	0	0	3	40	60	100
U19ECV45	IoT Processors	3	0	0	3	40	60	100
U19ECV46	IoT Enabled Systems Design	3	0	0	3	40	60	100
U19ECV47	Industrial IoT and Industrial 4.0	3	0	0	3	40	60	100
U19ECV48	IoT Security and Trust	3	0	0	3	40	60	100
U19ECV49	Online Course	3	0	0	3	40	60	100

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS-V NETWORKING

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV51	Mobile Adhoc Networks	3	0	0	3	40	60	100
U19ECV52	Wireless Sensor Networks	3	0	0	3	40	60	100
U19ECV53	Cryptography and Cyber Security	3	0	0	3	40	60	100
U19ECV54	Communication Switching and Networks	3	0	0	3	40	60	100
U19ECV55	Internet Protocol Services	3	0	0	3	40	60	100
U19ECV56	Cyber Security	3	0	0	3	40	60	100
U19ECV57	Fiber Optic Sensors	3	0	0	3	40	60	100
U19ECV58	Optical Networks	3	0	0	3	40	60	100
U19ECV59	Online Course	3	0	0	3	40	60	100

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS-VI ARTIFICIAL INTELLIGENCE

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV61	Artificial Intelligence and Machine Learning	3	0	0	3	40	60	100
U19ECV62	Deep Learning	3	0	0	3	40	60	100
U19ECV63	Neural Networks and its Applications	3	0	0	3	40	60	100
U19ECV64	Soft Computing	3	0	0	3	40	60	100
U19ECV65	Computer Vision	3	0	0	3	40	60	100
U19ECV66	Augmented Reality/ Virtual Reality	3	0	0	3	40	60	100
U19ECV67	Optimization Techniques	3	0	0	3	40	60	100
U19ECV68	Ethics in Artificial Intelligence	3	0	0	3	40	60	100
U19ECV69	Online Course	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

CURRICULUM

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

VERTICALS-VII ELECTRONICS ENGINEERING AND ADMINISTRATION SYSTEM

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

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.,**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**OPEN ELECTIVE**

CURRICULUM

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

LIST OF OPEN ELECTIVE

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
OPEN ELECTIVE-I									
U19ECOE1	Speech Processing	OE	3	0	0	3	40	60	100
U19ECOE2	Biomedical Instrumentation	OE	3	0	0	3	40	60	100
U19ECOE3	Automotive Electronics	OE	3	0	0	3	40	60	100
OPEN ELECTIVE-II									
U19ECOE4	Satellite Communication	OE	3	0	0	3	40	60	100
U19ECOE5	VLSI Design and Its Applications	OE	3	0	0	3	40	60	100
U19ECOE6	Digital Image Processing	OE	3	0	0	3	40	60	100
OPEN ELECTIVE-III									
U19ECOE7	Basics of Communication Systems	OE	3	0	0	3	40	60	100
U19ECOE8	Wireless Sensor Networks	OE	3	0	0	3	40	60	100
U19ECOE9	PCB Design and Fabrication	OE	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.Tech.**	Programme Code	**105**	Regulation	**2019**
Department	**BIOTECHNOLOGY**			Semester	-

CURRICULUM

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

LIST OF OPEN ELECTIVES

Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
PROFESSIONAL ELECTIVE - I								
U19BTOE1	Biology for Engineers	3	0	0	3	40	60	100
U19BTOE2	Biofuels and Bioenergy	3	0	0	3	40	60	100
U19BTOE3	Bio-Business	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE –II								
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
PROFESSIONAL ELECTIVE –III								
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

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**101**	Regulation	**2019**
Department	**Computer Science and Engineering**			Semester	**-**

CURRICULUM

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

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**102**	Regulation	**2019**
Department	**Electrical and Electronics Engineering**			Semester	-

CURRICULUM

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

LIST OF OPEN ELECTIVES

Course Code	Course Name	Hours / 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	Industrial Electrical Systems	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**106**	Regulation	**2019**
Department	**BIOMEDICAL ENGINEERING**			Semester	-

CURRICULUM

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

LIST OF OPEN ELECTIVES

Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19BMOE1	Biotelemetry	3	0	0	3	40	60	100
U19BMOE2	Virtual Instrumentation	3	0	0	3	40	60	100
U19BMOE3	Hospital Waste Management	3	0	0	3	40	60	100
U19BMOE4	Medical Robotics	3	0	0	3	40	60	100
U19BMOE5	Healthcare Management Systems	3	0	0	3	40	60	100
U19BMOE6	Biometric Systems And Their Applications	3	0	0	3	40	60	100
U19BMOE7	Basics of Biomedical Instrumentation	3	0	0	3	40	60	100
U19BMOE8	Medical Informatics	3	0	0	3	40	60	100
U19BMOE9	ICU and Operation Theatre Equipments	3	0	0	3	40	60	100

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**107**	Regulation	**2019**
Department	**Computer Science and Technology**			Semester	**-**

CURRICULUM

LIST OF OPEN ELECTIVES

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

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
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

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.Tech.**	Programme Code	**104**	Regulation	**2019**
Department	**INFORMATION TECHNOLOGY**			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
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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MINOR DEGREE VERTICALS OFFERED TO OTHER DEPARTMENT

VERTICAL II - CYBER SECURITY

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E. / B.Tech.**	Programme Code	101	Regulation	**2019**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**

CURRICULUM

(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
THEORY									
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

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MINOR DEGREE VERTICALS – EEE

Instrumentation & Control

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E. / B.Tech.**	Programme Code	102	Regulation	**2019**
Department	**Electrical & Electronics Engineering**			Semester	**-**

CURRICULUM

(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
THEORY									
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

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MINOR DEGREE VERTICALS – IT

VERTICAL IV - INTERNET OF THINGS & CLOUD COMPUTING

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E. / B.Tech.**	Programme Code	104	Regulation	**2019**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	-

CURRICULUM

(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
THEORY									
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
U19CSV44	Industry 4.0	PEC	3	0	0	3	40	60	100
U19ITV41	Software Defined Networks	PEC	3	0	0	3	40	60	100
U19ITV42	Information Storage and Management	PEC	3	0	0	3	40	60	100
U19CTV41	Fundamentals of Virtualization	PEC	3	0	0	3	40	60	100
U19CTV43	Big Data Tools and Techniques	PEC	3	0	0	3	40	60	100

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MINOR DEGREE VERTICALS – BT

VERTICAL II - ENTREPRENEURSHIP

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.TECH.**	Programme Code	105	Regulation	**2019**
Department	**BIOTECHNOLOGY**			Semester	**-**

CURRICULUM

(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
THEORY									
U19BTV21	Principles of Management	PEC	3	0	0	3	40	60	100
U19BTV22	Bio-Entrepreneurship	PEC	3	0	0	3	40	60	100
U19BTV23	Industrial Biosafety	PEC	3	0	0	3	40	60	100
U19BTV24	Bioethics & IPR	PEC	3	0	0	3	40	60	100
U19BTV25	Bioindustries & Entrepreneurship	PEC	3	0	0	3	40	60	100
U19BTV26	Total Quality management	PEC	3	0	0	3	40	60	100
U19BTV27	Audit and Regulatory Compliance	PEC	3	0	0	3	40	60	100
U19BTV28	Biobusiness	PEC	3	0	0	3	40	60	100
U19BTV29	Resource Management & Lean Start-up Management	PEC	3	0	0	3	40	60	100

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MINOR DEGREE VERTICALS – BME

VERTICALS – VI: HEALTHCARE MANAGEMENT

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**106**	Regulation	**2019**
Department	**BIOMEDICAL ENGINEERING**			Semester	**-**

CURRICULUM

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

Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19BMV61	Clinical Engineering	3	0	0	3	40	60	100
U19BMV62	Hospital Planning andManagement	3	0	0	3	40	60	100
U19BMV63	Medical WasteManagement	3	0	0	3	40	60	100
U19BMV64	Economics and Management forEngineers	3	0	0	3	40	60	100
U19BMV65	Bio Statistics	3	0	0	3	40	60	100
U19BMV66	Forensic Sciencein Healthcare	3	0	0	3	40	60	100
U19BMV67	AI and Its Medical Applications	3	0	0	3	40	60	100
U19BMV68	Medical Informatics	3	0	0	3	40	60	100

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MINOR DEGREE VERTICALS - CST

VERTICAL III - ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	107	Regulation	**2019**
Department	**COMPUTER SCIENEC AND TECHNOLOGY**			Semester	**-**

CURRICULUM

(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
THEORY									
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 Intelligentand 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

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S. No.	Category	CREDIT PER SEMESTER								Credits Total	% of Credits	Maximum Number of Credit Required as per AICTE
		I	II	III	IV	V	VI	VII	VIII			
1.	HSC	3	3+1[&]	1[&]	1			3		10+2[&]	6.03	12
2.	BSC	9	9	4	4					26	15.66	25
3.	ESC	8	8	5						21	12.65	24
4.	PCC		3	14	18	15	11	4		65	39.16	48
5.	PEC					3	3	9	6	21	12.65	18
6.	OEC					3	3	3		9	5.42	18
7.	EEC						2	4	8	14	8.43	15
TOTAL		20	23	23	23	21	19	23	14	166+2=168[&]	100	-

Cumulative Course Credit: **166 (2021-2025 Batch)**

Cumulative Course Credit: **168** [&] **(2022-2026 Batch)**

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MA101	**Calculus**	3	1	0	4	40	60	100

Course Objective

The Main Objective of the course is to
- Provide the information about Review of limits, continuity and differentiability.
- Understand maxima and minima of functions of two variables.
- Demonstrate Integral calculus.
- Identify the problems based on area, surface and volume.
- To Recognize the Second order linear differential equations.

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Apply Mean value theorem and Taylor's theorem.	K1,K3
CO2: Analyze Total derivative.	K2,K4
CO3: Formulate Reduction Formulae.	K3,K5
CO4: Translate Change of order of integration	K2,K5
CO5: Apply method of variation of parameters.	K3,K5

Pre-requisites -

CO / PO Mapping (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
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		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2. Assignment. 3..End-Semester examinations
Indirect
1.Course - end survey

Content of the syllabus

Unit – I	**DIFFERENTIAL CALCULUS**	Periods	**12**

Limit, continuity, differentiability , rules of differentiation, differentiation of various functions, Rolle's theorem(excluding proof), Mean value theorem(excluding proof), Taylor's theorem(excluding proof), Maxima and

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Minima. Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials – Chemical reactions and solutions, Ohm's law, Kirchoff's law- Simple electric circuit problems)

Unit - II	**FUNCTIONS OF SEVERAL VARIABLES**	Periods	**12**

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) – Maximum and minima of functions of two variables .

Unit – III	**INTEGRAL CALCULUS**	Periods	**12**

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 $\int_0^{\frac{\pi}{2}} \cos^n x dx$, $\int_0^{\frac{\pi}{2}} \sin^n x dx$.

Unit - IV	**MUTIPLE INTEGRALS**	Periods	**12**

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.

Unit – V	**ORDINARY DIFFERENTIAL EQUATIONS**	Periods	**12**

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.

	Total Periods	**60**

Text Books

1.	Stewart, J. Calculus: Early Transcendentals (8th Edition), Cengage Learning, 2015.
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

References

1.	Kreyszig E, Advanced Engineering Mathematics (10th Edition), John Wiley (2015).
2.	Boyce W E and DiPrima R, Elementary Differential Equations (9th 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)

E-Resources

1.	https://freevideolectures.com › All Courses › Calculus › UCLA
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E**	Programme Code	103	Regulation	2019		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		**I**		

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EN101	**English for Communication – I**	3	0	0	3	40	60	100

Objective	The main objective of this course is to: • To make learners listen to audio files and replicate it in speaking contexts. • To make learners read widely in order to practice writing • To make learners develop vocabulary and strengthen grammatical understanding • 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	
Course Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Speak adequately from the inputs they gained through listening.	K2
	CO2: Write appropriately based on the knowledge gained through reading of a variety of materials	K3
	CO3: Use language through their grammatical acquisition and their knowledge about using right word at the right context.	K3
	CO4: Listen the accents and tones of the language properly.	K2
	CO5: Comprehend and retain the contextual and syntax understanding from reading.	K4
Pre-Requisities	**Nil**	

CO / PO Mapping
(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						2			3	3		3		2	3
CO 2						2			3	3		3		2	3
CO 3						2			3	3		3		2	3
CO 4						2			3	3		3		2	3
CO 5						2			3	3		3		2	3

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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

Content of the syllabus

Unit - I		Periods	**9**

Listening-Introduction to Different Types of Listening, Listening to Casual Conversations, **Speaking-** Introduction to develop the Art of Speaking, Giving Self Introduction, **Reading** – Understanding the Basics of Reading Skills, Reading Instructions and Technical Manuals, **Writing**- Introduction to writing strategies, Writing Definitions, **Focus on Language** - -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).

Unit - II		Periods	**9**

Listening- Listening to lectures, listening to description of equipment, **Speaking-** Strategies for Developing Conversational Skills, Short Conversations through Role Play Activities, **Reading** – Reading Comprehension, Reading e-mails, Reading Headlines, Predicting the Content, **Writing**- Note making, Writing Descriptions, **Focus on Language** – Collocations, Functional Use of Tenses, Subject - verb agreement

Unit - III		Periods	**9**

Listening- Listening to different kinds of interviews (Face - to - face, radio, TV and telephone interviews), **Speaking-** Describing an Object, Asking Questions, Participating in Discussions **Reading** – Intensive reading, Reading passages for gist. **Writing**- Informal writing -short e-mails with emphasis on Brevity, Clarity, Coherence and Cohesion), **Focus on Language** –Sequential Connectives, Impersonal Passive

Unit - IV		Periods	**9**

Listening- Note Taking, **Speaking-** Improving Fluency through Narration. **Reading** – Reading passages for specific information- Phone messages, Reading and Transferring Information. **Writing**- Effective writing strategies, Informal writing, Writing a Memo, **Focus on Language** – Pronunciation Practice (Phonetic sounds - Vowels, Consonants and Diphthongs), Cause and Effect, Conditional Statements (if - clauses and types), Usage of Modal Verbs.

Unit - V		Periods	**9**

Listening- Listening to understand Modulation, Listening to Welcome Speeches, **Speaking-** Delivering Welcome Addr**ess,** Understanding Segmental and Supra segmental Features-Practicing Stress, Pause and Intonation, **Reading** – Reading for a purpose, Reading Business Documents, Interpreting Charts and Graphs,. **Writing**- Writing Business e-mails, Describing a Process. **Focus on Language** - Synonyms and Antonyms, Common Errors in English.

	Total Periods	45

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 EnglishVersatile 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.

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2.	Dutt Rajeevan, 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	http://www.sparknotes.com/lit/the-alchemist/summary.html
2	https://www.stephencovey.com/7habits/7habits.php
3	http://en.wikipedia.org/wiki/The_Seven_Habits_of_Highly_Effective_People

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	B.E.	Programme code		103	Regulation		2019
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			I

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19CH105	**Engineering Chemistry**	3	0	0	3	40	60	100

Objective	The main objective of this course is: • To recognize the basic technology requirements in water treatment • To gain knowledge in Polymeric materials towards engineering application. • To Enrich the Knowledge of the students with the basics of Nano materials, their properties and applications. • Familiarize about the energy and different types of batteries in the engineering application. • Gain knowledge in destruction of metals and protection for engineering applications.	
Course Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Implement innovative solutions in waste water treatment process	K3
	CO2: Identify the application of a specific polymer in the field of engineering	K2
	CO3: Forecast the information of Nanoparticles and their industrial applications	K2
	CO4: Recognize the renewable energy devices for sustainable energy.	K3
	CO5: Identify the rate of corrosion of a metal in a given environment and find out appropriate control techniques to avoid corrosion.	K3
Pre-Requisities	**Nil**	

CO / PO Mapping (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**
CO 1	3	3	2	2		2	2				1	2	2	1	2
CO 2	3	2	2	1		2	2				1	1	2	1	1
CO 3	3	2	3	2	1	2	1				1	1	1	1	1
CO 4	3	3	2	2	2	3	3				1	2	3	2	2
CO 5	3	3	2	2	1	3	2				2	2	1	1	2

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Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment : simulation using tools 3.End-Semester examinations
Indirect
1.Course - end survey

Content of the syllabus

Unit - I	**WATER TECHNOLOGY**	Periods	9

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-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.

Unit - II	**POLYMER CHEMISTRY**	Periods	9

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.

Unit - III	**NANO CHEMISTRY**	Periods	9

Basics- distinction between molecules, nanoparticles and bulk materials; size dependent properties. Nanoparticles: nanocluster, nanorod, nanotube (CNT) and nanowires. 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.

Unit - IV	**RENEWABLE ENERGY AND STORAGE DEVICES**	Periods	9

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.

Batteries and fuel cells: Types of batteries - Dry cells-Alkaline battery, lead storage battery, Ni-Cd battery, lithium battery, Fuel cell - H2-O2 fuel cell-applications.

Unit - V	**CORROSION AND ITS CONTROL**	Periods	9

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. Protective coatings – Paints: constituents and functions, Metallic coatings - steps involved in cleaning the surface for Electroplating, Electroplating (Au), Electro less plating (Ni).

	Total Periods	45

Text Books:

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

References:

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

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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
E-Resources.	
1	https://www.who.int/water_sanitation_health/dwq/arsenicun6.pdf
2	https://www.schandpublishing.com/books/tech-professional/applied-science/a-textbook-polymer-chemistry/9788121941129/#.XdZ214MzY2w
3	https://www.elsevier.com/books/nanochemistry/klabunde/978-0-444-59397-9

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E./B.Tech.**	Programme Code			Regulation		**2019**	
Department	**CSE, EEE, ECE, IT & Bio-Tech.**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19CS101	**Programming for Problem Solving**	3	0	0	3	40	60	100

Course Objective

The main objective of this course is to:

- Learn the fundamentals of computers and acquire problem solving skills
- Understand C programming concepts
- Write the programs using arrays and strings
- Write the programs using functions
- Write the programs using structures.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Write the algorithms and to draw flowcharts for solving problems.	K3
	CO2: Analyze the basics of C programming language.	K4
	CO3: Implement the C programs using arrays and strings.	K4
	CO4: Develop C programs using the functions and pointers.	K3
	CO5: Solve the real time problems using Structures and union	K3

CO / PO Mapping (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	3		2			3	3	3	3	2	3		
CO 2	3	3	3		2			3	3	3	3	2	3		
CO 3	3	3	3		2			3	3	3	3	2	3		
CO 4	3	3	3	2	2			3	3	3	3	2	3		
CO 5	3	3	3	3	2			3	3	3	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

Content of the syllabus

Unit – I	**INTRODUCTION TO PROBLEM SOLVING**	Periods	**9**

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.

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Unit - II	C PROGRAMMING	Periods	9
Introduction to C – Features - Data Types – Constants – Variables - I/O Statement - Operators –Expressions - Decision Making and Branching – Looping Statements - Break, Goto, Continue.			
Unit – III	**ARRAYS AND POINTERS**	Periods	**9**
Arrays: Concepts – Need – one dimensional array – array declaration – features – array initialization - Two-Dimensional Arrays- Multidimensional Arrays. Pointers: Introduction, pointer declaration-accessing variable through pointer-pointers and Arrays, Pointers and strings – Pointers structures-pointer Arithmetic - Array of Pointers – dynamic memory allocation.			
Unit - IV	**FUNCTIONS AND STRINGS**	Periods	**9**
Function: Introduction, function declaration, defining and accessing functions, User-defined Functions- storage classes-function prototypes-parameter passing methods-recursion. Strings: Concepts – Strings manipulation - String Input / Output Functions- Strings standard functions - Arrays of Strings.			
Unit – V	**STRUCTURES AND UNIONS**	Periods	**9**
Structures-Introduction- nested structures- Arrays of Structures - Structures and Functions - Pointers to Structures – Unions- Type Definition – Bitfields- Enumerated Types.			
		Total Periods	**45**

Text Books	
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.
References	
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.
E-Resources	
1.	https://www.geeksforgeeks.org/c-language-set-1-introduction/
2.	https://www.programiz.com/c-programming
3.	https://www.cprogramming.com/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation			**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19GE101	**Engineering Graphics**	2	0	3	3	40	60	100

Course Objective

The main objective of this course is to:

- 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.
- Project the drawing of various solids.
- Sketch sectioned views of solids.
- Draw the development of surfaces.
- Draw the isometric and orthographic projections for any given object to the required standard.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Construct plane curves and develop projection of points, lines and plane surfaces	K2
	CO2: Construct projection of solids with various conditions.	K4
	CO3: Design the section of solids and analyze the true shape of the section	K3
	CO4: Design and develop the different solid surfaces.	K2
	CO5: Construct isometric and orthographic projection of different solids.	K1

Pre-requisites Nil

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	3	3	3	-	-	-	-	-	-	-	2	2	-
CO 2	3	3	2	2	2	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	2	2	3	-	-	-	-	-	-	-	2	3	-
CO 4	3	2	3	3	2	-	-	-	-	-	-	-	3	-	-
CO 5	3	3	2	3	3	-	-	-	-	-	-	-	3	2	-

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Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Concepts & Conventions(Not for Examination)	Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	**Periods**	**1**
Unit – I	**PROJECTION OF POINTS, LINES AND PLANE SURFACES**	**Periods**	**3+8**
Introduction to Plane curves, Orthographic projection – principles – projection of points, straight lines (only first angle projections) and plane surfaces (polygonal and circular).			
Unit - II	**PROJECTION OF SOLIDS**	**Periods**	**3+8**
Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.			
Unit - III	**SECTION OF SOLIDS**	**Periods**	**3+8**
Sectioning of solids - prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other - Obtaining true shape of section.			
Unit - IV	**DEVELOPMENT OF SURFACES**	**Periods**	**3+8**
Development of lateral surfaces of simple solids like prisms, pyramids, cylinders and cones – development of simple truncated solids involving prisms, pyramids, cylinders and cones.			
Unit - V	**ISOMETRIC PROJECTIONS, ORTHOGRAPHIC VIEWS FROM PICTORIAL VIEWS**	**Periods**	**5+10**
Isometric Projection and Introduction to AutoCAD / Solid Edge: Principles of isometric projection - Isometric scale - Isometric projections of simple solids like prisms, pyramids, cylinders and cones & orthographic views from pictorial views.			
Demonstration only: Computer Aided Drafting (Auto CAD / Solid Edge): Introduction to drafting packages and demonstration of their use.			
		Total Periods	**60**

Text book:

T1.	Basant Agrawal and C.M Agrawal ,"Engineering Drawing ",Tata McGraw Hill ,Third Edition, 2019
T2	Jain and Gautam ,"Engineering Graphics & Design ",Khanna Publishing House, 2018

References:

R1.	Dr.P.Kannan and Dr.J.Bensam Raj, "Engineering Graphics", JBR Tri Sea Publishers Pvt. Ltd, 2018.
R2.	K.V Natarajan, "Engineering Drawing and Graphics", M/s. N.Dhanalakshmi, Chennai, 2014.
R3.	K.Venugopal and V. Prabhu Raja, "Engineering Graphics"New Age International Publishers, 2011.
R4.	N.S Parthasarathy and Velamurali, " Engineering Graphics", Oxford University, New Delhi,2015
R5.	Bhatt N.D and Panchal V.M, "Engineering Drawing", Charotar Publishing House,50th Edition,2010

e-RESOURCES:

E1.	http://nptel.ac.in/courses/105104148, "Engineering Graphics" - Dr. Nihar Ranjan Patra , IIT Kanpur
E2.	http://cfd.annauniv.edu/webcontent.htm, "Engineering Graphics" - Dr.Velamurali
E3.	http://link.springer.com/ "Engineering Graphics"-Springer Nature.

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

Programme	B.E.	Programme code	103	Regulation	2019
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	I

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19CH106	**Chemistry Laboratory**	**0**	**0**	**4**	**2**	**60**	**40**	**100**

Objective

The main objective of this course is to:

- Gather basic simple acid-base reactions and study the mechanism of acid mixture with base.
- Learn pH and potential of hydrogen in a sample solution.
- Study the redox reaction through potential difference.
- Quote iron forms complex with thio cyanate.
- Gather knowledge on hardness producing salts and removal of hardness through estimation.
- Collect data required for dissolved oxygen present in water sample.
- Understand alkalinity and available chlorine present in water sample.

Outcomes

The students who complete this course successfully are expected to:	Knowledge Level
CO1: Infer knowledge on neutralization reaction between acid, acid mixture with base and identify the concentrations.	K3
CO2: Spot the concentration of sample solution through potential of hydrogen and redox reaction.	K3
CO3: Estimate Iron by complexation reaction spectrometrically.	K5
CO4: Determine hardness and dissolved oxygen present in domestic water supply.	K5
CO5: Identify alkalinity and available chlorine present in the given sample.	K5

Pre-requisites: Nil

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	1	1					2	2	2	
CO 2	3	3		2	1							1	2	2	
CO 3	3	3		2	1								2	2	
CO 4	3	3	1	2	2	2	2					2	2	1	
CO 5	2	3	1	2	2	2	2					2	2	1	

S.No	LIST OF EXPERIMENTS	
1.	Estimation of HCL using NaOH by Conductometric titration	CO1

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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
	Total Periods	**45**

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

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

Programme	**B.E.**	Programme Code		Regulation	**2019**
Department	**CSE, EEE, ECE, IT & Bio-Tech.**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19CS102	**Computer Practices Laboratory**	0	0	4	2	60	40	100

Course Objective

The Main Objective of the course is to

- Make the students to learn the programming language
- Understand the basic programming constructs and articulate how they are used
- Develop a program with a desired runtime execution flow
- Articulate where computer programs fit in the provision of computer based solutions to real world problems

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Prepare document using word processor	K3
	CO2: Sketch flow of execution of C programs using algorithm and flowcharts	K3
	CO3: Write the simple C Programs using decision and looping statements	K3
	CO4: Demonstrate code reusability with the help of user defined functions and pointers.	K4
	CO5: Write programs that perform operations using derived data types.	K3

CO / PO Mapping
(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	3	1				3	3	3	3	3	3	1	
CO 2	3	3	3	1				3	3	3	3	3	3	1	
CO 3	3	3	3	1				3	3	3	3	3	3	1	
CO 4	3	3	3	3				3	3	3	3	3	3	1	
CO 5	3	3	3	3				3	3	3	3	3	3	1	

Course Assessment Methods

Direct
1. Prelab and post lab test
2. End-Semester examinations
Indirect
1. Course - end survey

SUGGESTED LIST OF EXPERIMENTS — CO1

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

Consumption Units	Rate of Charge
0-200	Rs.0.50 per unit

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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.	

2. Design an algorithm and flowchart for a simple calculator program using word processor for performing various arithmetic operations such as — CO2

   "+" - Addition
   "-" - Subtraction
   "*" - Multiplication
   "/" - Division
   "%" - Modulus

3. Design and develop a C program to accept a number from the user and check whether it is a palindrome or not. — CO3
   Palindrome number : (a number is a Palindrome which when read in reverse order is same as read in the right order)

   Example: Palindrome :11, 101, 151

   Not a Palindrome:123 , 100

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. — CO3

   Test Case:

   Sample Input: 15390

   Sample Output:

   Sum of the digits=18

   No. of digits = 5

   For an incorrect choice, an appropriate error message should be displayed.

5. Develop a program to perform the following operations using two dimensional or multi-dimensional matrices: — CO3

   a. Addition of two matrices (3x3)

   b. Subtraction of two matrices (2x2)

   c. Multiplication of two matrices using dynamic memory allocation.

6. Write a program to find the maximum and minimum element in a set of inputs using one dimensional array. — CO3

7. Write a program to count the total number of vowels and consonants in a string. For example — CO4

   Input string: I am proud to be an Indian

   Output: Total vowels – 10 and Total consonants - 10

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8. Develop a program to perform the following string manipulations without using string functions: a. String copy b. String Concatenate c. String length d. String Compare	CO4
9. The Fibonacci numbers are defined recursively as follows: F1=1 F2=1 Fn= Fn-1 + Fn-2, n>2 Write a function that will generate and print the first n Fibonacci numbers. Test the function for n=5,10,15	CO4
10. Write a function using pointers to exchange the values stored in two locations in the memory. Test Case : Input : A=10 , B=-5 Output : A= -5 , B=10	CO4
11. Develop a program to build a database of students with the following attribute: 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 >=60% are belongs to first division. Similarly, for second and third division students having conditions 50 %< =percentage<60% and 35 %< =percentage<50% 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.	CO5

Total Periods	**45**

E-Resources

1.	https://www.programiz.com/c-programming
2.	https://www.cprogramming.com/
3.	https://beginnersbook.com/2015/02/simple-c-programs/

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Programme	**B.E.**	Programme Code		Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**I**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MCFY2	**Indian Constitution and Universal Human Values**	3	0	0	0	100	-	100

Course Objective	The main objective of this course is to: i) To know about Indian constitution. ii) To know about central and state government functionalities in India iii) To know about Indian society.	
Course Outcome	At the end of the course, the student will be able to	Knowledge Level
	• Understand the functions of the Indian government	K1
	• Understand and abide the rules of the Indian constitution	K1
	• Understand and appreciate different culture among the people	K1
	• Understanding human being as a co-existence of the sentient 'I' and the material	K1, K2
	• '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 ecofriendly Production systems	K2
Pre-requisites	---	

CO / PO Mapping (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	3						
CO 3						3		3	2						
CO 4						3		3	3						
CO 5						3		3	3						

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

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Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**9**
Historical Background – Constituent Assembly of India – Fundamental Rights – Citizenship – Constitutional Remedies for citizens			
Unit - II	**STRUCTURE AND FUNCTION OF CENTRAL**	Periods	**9**
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India			
Unit – III	**STRUCTURE AND FUCTION OF STATE**	Periods	**9**
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts			
Unit - IV	**UNIVERSAL HUMAN VALUES**	Periods	**9**
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education			
Unit – V	**OPTOEL UNIVERSAL HUMAN VALUES - PROFESSIONAL ETHICS ECTRONICS**	Periods	**9**
Understanding Harmony in the Human Being - Harmony in Myself and society.			
		Total Periods	**45**

Text Books	
1.	Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2.	Tanu shukla,Human Values and professional Ethics, Cengage publications.
References	
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
E-Resources	
1.	https://mhrd.gov.in/
2.	https://niti.gov.in/content/niti-aayog-library
3.	www.drishtiias.com/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**II**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MA202	**Linear Algebra and Ordinary Differential Equations**	3	1	0	4	40	60	100

Course Objective

The Main Objective of the course is to

- Understand Eigen values and Eigen vectors and its role in the system of equations.
- Proficiently understand the vector differential calculus.
- Demonstrate vector integral calculus.
- To know about Cartesian and Polar co-ordinates and also transformations.
- Identify the Laplace transform of derivatives and integrals.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Analyze the Reduction of a quadratic form.	K3, K4
	CO2: Identify vector differential calculus.	K2, K3
	CO3: Apply Green's , Stoke's and Gauss Divergence theorems	K1, K5
	CO4: Identifying the analytic functions	K2, K5
	CO5: Recognize the Laplace transform of unit step and unit impulse functions.	K5, K3

Pre-requisites -

CO / PO Mapping
(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		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment. 3.End-Semester examinations
Indirect
1.Course - end survey

Content of the syllabus

Unit – I	**MATRICES**	Periods	**12**

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

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application in encoding message using 2×2 matrix.			
Unit - II	**VECTOR DIFFERENTIAL CALCULUS**	Periods	**12**
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.			
Unit – III	**VECTOR INTEGRAL CALCULUS**	Periods	**12**
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.			
Unit - IV	**ANALYTIC FUNCTIONS**	Periods	**12**
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.			
Unit – V	**LAPLACE TRANSFORMS**	Periods	**12**
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.			
		Total Periods	**60**

Text Books	
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
References	
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)
E-Resources	
1.	https://en.wikipedia.org › wiki › Ordinary_differential_equation
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205					
Programme	B.E.	Programme code	103	Regulation	2019	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	II	

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EN202	**English for Communication - II**	3	0	0	3	40	60	100

Objective	The main objective of this course is to: • To provide suitable listening tasks to develop communicative ability for academic and professional progress • To inculcate channelized reading to make learners proficient in the chosen professional writing contexts. • To improve learners' vocabulary and grammar to supplement their language use at professional contexts • 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	
Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Acquire sufficient command over language to speak at an academic or professional context through continuous exposure to similar listening tasks.	K2
	CO2: Write technically well at a professional contexts through exposing them to similar readings.	K3
	CO3: Use language at length at technical and professional situations through the enrichment of vocabulary and strengthening of grammatical knowledge.	K3
	CO4: Students should be able to ethically gather, understand, evaluate and synthesize information from a variety of written and electronic sources.	K2
	CO5: Students should be proficient in oral communication and writing.	K4
Pre-requisites	**Nil**	

CO / PO Mapping
(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
CO 1						2			3	3		3		2	3
CO 2						2			3	3		3		2	3
CO 3						2			3	3		3		2	3
CO 4						2			3	3		3		2	3
CO 5						2			3	3		3		2	3

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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

	Content of the syllabus		
Unit - I		Periods	**9**
Listening- Listening for Cultural Awareness, Listening to Professional Conversations, Talks, Interviews and Lectures **Speaking-** Developing Confidence to get rid of Fear on the Dias, Discussion at a Corporate Context. **Reading**– Inferential Reading, Reading Short Messages and Technical Articles, **Writing-** Introduction to Letter Writing, Writing Formal and Informal Letters, Thanking Letters, Letters Calling for Quotations, Letters Placing an Order, Seeking clarification, Letters of Complaint. **Focus on Language**–Adjectives and Degrees of Comparisons			
Unit - II		Periods	**9**
Listening- Listening to specific information relating to technical content, Listening for statistical information **Speaking-** Expressing opinions, Formal Discussions, Describing Role Play at Business Context and Consolidating Ideas. **Reading**–Reading Technical Articles in Journals and Comparing Articles. **Writing-** Letter seeking permission to undergo practical training and to undertake project work. **Focus on Language**– Simple, compound and complex sentences and Transformation of Sentences.			
Unit - III		Periods	**9**
Listening- Listening to understand the overall meaning, Listening to Interviews and Presentations. **Speaking-** Giving Instructions and Showing Directions and Rephrasing Instructions. **Reading**– Skimming and Scanning, Reading Job Advertisements. **Writing-** Applying for a Job, Writing a CV. **Focus on Language**– Pronouns, Phrasal verbs, Restrictive and Non - restrictive clauses.			
Unit - IV		Periods	**9**
Listening- Listening and retrieving Information. **Speaking-** Developing fluency and Coherence, Accent Neutralization, Voice Modulation, and Intonation, Improving Voice Quality. **Reading**–Reading and understanding Advertisements. **Writing-** Letters to the Editor, Letter of Complaint, Various kinds of Reports, Permission to go for Industrial visits. **Focus on Language**– Countable, Uncountable nouns, Recommendations, Discourse Markers and Comparative and Contrastive Connectives, Imperatives.			
Unit - V		Periods	**9**
Listening- Listening to Fragmented Texts and Filling in the Blanks. **Speaking-**Mind Mapping, Developing Coherence and Self-Expression, Making presentations, Paralinguistic and Extra linguistic Features (body language), **Reading**– Predicting content, Interpreting Reports. **Writing-** Writing Proposals, Agenda, Minutes of the Meeting. **Focus on Language**– British and American Vocabulary, Editing, Error Detection, and Punctuation.			
		Total Periods	**45**

Text books

1.	Sumant.S,Pereira Joyce, English for Communication, Vijay Nicole Imprints Pvt.Ltd., 2014.
2.	Sokkaalingam, S.RM., The Art Of Speaking EnglishVersatile Publishing House,2018.

Reference books

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.

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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.
E-Resources	
1	http://www.kalevleetaru.com/Publish/Book_Review_Who_Moved_My_Cheese.pdf
2	http://www.bookbrowse.com/reviews/index.cfm/book_number/304/who-moved-my-cheese
3	http://www.imdb.com/title/tt0482629/plotsummary

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ECE & EEE**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19PH207	**Engineering Physics**	3	0	0	3	40	60	100

Course Objective

The student should be made to,
- understand the basic concepts of properties of matter
- gain knowledge about the conduction properties of metals
- identify the different types of crystal structures and crystal growth techniques. Study the production and applications of ultrasonics.
- correlate better understanding the carrier concentration and its variations with temperature in a semiconductor. Study the properties of modern engineering materials and its uses
- categorize the types of laser and fiber optics

Course Outcome

At the end of the course, the student will be able to	Knowledge Level
• understand the elastic properties of the materials	K2
• gain knowledge about the conduction properties of metals	K3
• determine packing factor for various unit cells and understand different types of crystal imperfections	K1
• discuss the basic idea of semiconducting materials and realize the function of modern engineering materials	K1
• learn the optical properties of materials and its uses	K3

Pre-requisites ---

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	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	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.End-Semester examinations
Indirect
1.Course - end survey

Content of the syllabus

Unit – I	**PROPERTIES OF MATTER**	Periods	**9**

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Elasticity: 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.
Viscosity: Co-efficient of viscosity - Poiseuilles' formula - Experimental determination – uses.

Unit - II	**ELECTRONS IN SOLID**	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.
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).

Unit – III	**CRYSTAL PHYSICS AND ULTRASONICS**	Periods	**9**

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.
Ultrasonics: Introduction – Magnetostriction and Piezoelectric Oscillator methods – Applications: Sound Navigation and Ranging (SONAR), Non – Destructive Testing (NDT) and Sonogram.

Unit - IV	**SEMICONDUCTING & MODERN ENGINEERING MATERIALS**	Periods	**9**

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.
Metallic glasses: preparation, properties and applications - Shape memory alloys (SMA): Characteristics and applications of NiTi alloy.

Unit – V	**LASER AND FIBER OPTICS**	Periods	**9**

Laser: Characteristics of laser –Derivation of Einstein's A and B coefficients. Types: Nd-YAG laser - Semiconductor laser: Homo junction - Applications.
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.

	Total Periods	**45**

Text Books

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

References

1.	B.K. Pandey, S. Chaturvedi. "Engineering Physics", 1st 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, 6th 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

E-Resources

1.	www.e-booksdirectory.com
2.	Home.iitk.ac.in
3.	physics.cu.ac.bd/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**Common to CSE,IT,ECE,BT branches**				Semester		**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EE201	**Basic Electrical and Electronics Engineering**	3	0	0	3	40	60	100
Course Objective	The students should made to • Learn the basic concepts of electrical parameters and electrical machines • Learn the electrical wiring methods • Learn the basics about semiconductor families and digital logics							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: Understand the basics of electric circuits and type of the connection							K2
	CO2: Understand the basics of electromagnetic laws and basic working principle of DC and AC machines.							K2
	CO3: Understand the concepts of tariff, energy saving, illumination, electric lamps and safety measures.							K2
	CO4: Understand the basic operating characteristics of semiconductor devices.							K2
	CO5: Understand the fundamentals of digital logics and integrated circuits.							K2
Pre-requisites	Basic concepts and understanding of magnetic fields							

CO / PO Mapping (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										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 3.End-Semester examinations
Indirect
1.Course – end Survey

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Content of the syllabus

Unit – I	INTRODUCTION OF ELECTRICAL CIRCUITS	Periods	9

Definition of Voltage, Current, Power, Energy, Power factor, Circuit parameters, Ohm‟s law, Kirchoff‟s law. Concepts of AC Circuits- RMS value, Average value, Form and Peak factors, Concept of real and reactive power. Introduction to three phase systems - types of connections, relationship between line and phase values. Concept of DC circuits

Unit - II	INTRODUCTION OF ELECTRICAL MACHINES AND MEASUREMENTS	Periods	9

Faraday's laws of electromagnetic induction - Lens law - Fleming's left hand rule and Right hand rule. Working principle and construction of AC and DC machines -Working principle and construction of Transformer- Introduction to electrical measuring instruments – Analog and Digital Instruments **(Qualitative)**

Unit – III	WIRING AND ILLUMINATION	Periods	9

Types of wiring-staircase and corridor wiring - wiring accessories. Different types of safety measures - Earthing. Electrical tariff - Energy conservation. Simple layout of power system-various energy resources,. The Laws of Illumination - Different types of electrical lamps.

Unit - IV	SEMICONDUCTOR DEVICES	Periods	9

PN junction diodes - Zener diodes - characteristics. Transistors: PNP and NPN transistors - Theory of operation - Transistor configurations -characteristics - comparison. Special semiconductor devices: FET - SCR - LED – V-I characteristics –UPS – SMPS.

Unit – V	DIGITAL FUNDAMENTALS	Periods	9

Number systems - Boolean Theorems – De Morgan's Theorem - Logic gates -Implementation of Boolean Expression using Gates - Introduction to Operational Amplifier.

Total Periods	**45**

Text Books

1.	D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, Third Edition, 2016.
2.	M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford, 2016.

References

1.	S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016
2.	Mittle,Mittal, Basic Electrical Engineering‖, 2nd Edition, Tata McGraw-Hill Edition, 2016.
3.	S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015.
4.	John Bird, ―Electrical and Electronic Principles and Technology, Fourth Edition, Elsevier, 2010.
5.	K Murugesh Kumar, Elements of Electrical Engineering, Vikas Publishing House Pvt. Ltd.2011.

E-Resources

1.	https://nptel.ac.in/courses
2.	https://www.electrical4u.com/electrical-engineering-articles/illumination-engineering/
3.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/lecture-notes

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**II**			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19GE202	**Basic Civil and Mechanical Engineering**	3	0	0	3	40	60	100

Course Objective

The main objective of this course is to:

- Familiarize the materials and measurements used in Civil Engineering.
- Provide the exposure on the fundamental elements of civil engineering components and structures.
- Impart basic knowledge of power plants, pumps & boilers.
- Study the various types of IC engines and understand the features of IC engine.
- Enable the students to distinguish the components and working principle of refrigeration and air conditioning system.

Course Outcomes

At the end of the course, the student should be able to	Knowledge Level
CO 1: Explain the usage of civil engineering materials and measure the location of points in surveying	K2
CO 2: Identify the nature of building components, structures and material qualities.	K1
CO 3: Classify the various types of power plant, pump, turbine & boiler	K2
CO 4: Compare spark ignition and compression ignition of two stroke and four stroke engine.	K2
CO 5: Elaborate the working principle of refrigeration and air conditioning system.	K.3

Pre - requisites: Nil

CO / PO Mapping
(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	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	3	-	-	-	-	-	-	-	3	2	-
CO 2	3	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	2	-	2	-	-	-	-	-	-	-	2	2	-
CO 4	3	3	2	-	2	-	-	-	-	-	-	-	2	-	-
CO 5	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-

Course Assessment Methods

Direct

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

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Indirect	
1.Course - end survey	

Content of the syllabus

Unit – I	**CIVIL ENGINEERING MATERIALS AND SURVEYING**	**Periods**	**9**

Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel sections.
Surveying: Introduction to Surveying & Leveling.

Unit - II	**BUILDING COMPONENTS AND STRUCTURES**	**Periods**	**9**

Foundations: Site selection, Foundation – Types – Requirement of good foundations.
Superstructure: Brick masonry – Stone masonry – Beams – Columns – Lintels – Roofing – Flooring - Plastering.

Unit - III	**POWER PLANT ENGINEERING**	**Periods**	**9**

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.

Unit - IV	**IC ENGINES AND AUTOMOTIVE VEHICLES**	**Periods**	**9**

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 - Introduction to Electric vehicles.

Unit - V	**REFRIGERATION AND AIR CONDITIONING SYSTEM**	**Periods**	**9**

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.

Total Periods	**45**

Text book:

T1.	Dr.P.Kannan, "Basic Mechanical Engineering", JBR Tri Sea Publishers Pvt. Ltd., 2019.
T2	Pravin Kumar, "Basic Mechanical Engineering", Pearson Publishers, New Delhi, 2013.

References:

R1.	Dr.S.Ramachandaran, " Basic Civil and Mechanical Engineering " Air Walk Publication,2016
R2.	R.Gupta, "Basic Civil Engineering", RPH Publication, 2016.
R3.	Mrs.V.Valarmathi, Mr.K.Rajasekar & Mr.T.Satheeskumar,"Basic Civil Engineering", JBR Tri Sea Publishers Pvt. Ltd., 2017.
R4.	G.Shanmugam and M.S Palanichamy, "Basic Civil and Mechanical Engineering ",Tata McGraw Hill Publishing Company Limited,New Delhi,2014
R5.	S.Seetharaman, " Basic Civil Engineering ",Anuradha Agencies,2005

e-RESOURCES:

E1.	https://nptel.ac.in/downloads/105105104/
E2.	https://nptel.ac.in/courses/112107216/
E3.	http://link.springer.com/ "Basic Civil and Mechanical Engineering"-Springer Nature.

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**II**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
U19EC201	**Electric Circuit Theory**	3	0	0	3	40	60	100

Course Objective	The students should made to • To introduce electric circuits and its analysis • Impart knowledge on solving circuits using network theorems • Learn the phenomenon of resonance and coupled circuits. • Learn the transient response of circuits for various inputs • Learn about two port networks and its parameters.	
Course Outcome	At the end of the course, the student should be able to,	**Knowledge Level**
	CO1: Understand the basic laws, mesh current, nodal voltage methods for solving circuit problems.	K2
	CO2: Understand the basic network theorems and its applications to solving networks for both DC and AC inputs.	K2
	CO3: Understand the concepts of series & parallel resonance and coupled circuits..	K2
	CO4: Understand the concepts of Circuit Transients for different inputs	K2
	CO5: Understand the two-port networks, parameters and its interconnections.	K2
Pre-requisites	Basic concepts of physics, particularly about Electricity and Magnetism.	

CO / PO Mapping (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**
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 and Quiz 3. End-Semester examinations
Indirect

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1. Course - end Survey

Content of the Course

Unit – I	**BASIC CIRCUITS ANALYSIS**	Periods	**9**
Fundamental concepts of DC circuits, Ohm's Law and Kirchoff's law-Series and Parallel circuits - Loop and Nodal analysis, A.C circuits - Complex impedance - Phasor diagram, Real and Reactive power .Loop and Nodal analysis for AC circuits. Network Topology-Graph-Tree Link and Co-tree-Network variables-Incidence Matrix-Tie-set-Cut set-Duality			
Unit - II	**NETWORK THEOREMS**	Periods	**9**
Voltage source –Current source transformations, Network Theorems -Superposition Theorems – Thevenin's and Norton's Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem-Applications to DC and AC circuits, Star-Delta transformations			
Unit – III	**RESONANCE AND COUPLED CIRCUITS**	Periods	**9**
Resonance in Series and Parallel Circuits, Self and Mutual Inductances, Quality factor and Bandwidth, Coefficient of coupling – Dot convention - Analysis of coupled circuits. Single Tuned and Double tuned Coupled Circuits.			
Unit - IV	**TRANSIENT ANALYSIS OF DC AND AC CIRCUITS**	Periods	**9**
Natural and Forced response ,Transient response of RL, RC and RLC Circuits using Laplace transform for DC, Step, Impulse inputs. and A.C. Sinusoidal input			
Unit – V	**TWO PORT NETWORKS**	Periods	**9**
Two Port Networks, Characterization of LTI two port Networks- Impedance parameters- Admittance parameters, Transmission parameters and Hybrid parameters, Relationship between two port parameters, interconnections of Two port networks			
		Total Periods	**45**

Text Books

1.	William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.
2.	Charles K. Alexander, Matthew N. O. Sadiku, 'Fundamentals of Electric Circuits', McGraw-Hill Publications, 3rd Edition, 2007.
3.	D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.

References

1.	Joseph. A. Edminister, 'Electric Circuits - Schaum's outline series', McGraw Hill Publications, 6 t h Edition, 2003.
2.	Robins & Miller, 'Circuit Analysis Theory and Practice', Delmar Publishers, 5th Edition, 2012.

E-Resources

1.	https://nptel.ac.in/courses/117106108/
2.	http://www.ee.iitm.ac.in/videolectures/doku.php?id=ec1010_2014nk:start
3.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/lecture-notes

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

Programme	B.E./ B.TECH	Programme code		Regulation	2019
Department	**CSE,EEE,ECE,IT,BT, BME & CST**		Semester		II

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19TN201	□ □ □□ □ □□ □ □ □ **Heritage of Tamils**	2	0	0	1	40	60	100

Content of the syllabus

myF 1	**nkhop kw;Wk; ,yf;fpak;**	**Periods**	**3**

,e;jpa nkhopf; FLk;gq;fs; - jpuhtpl nkhopfs; - jkpo; xU nrk;nkhop – jkpo; nrt;tpyf;fpaq;fs; - rq;f ,yf;fpaj;jpd; rkar; rhh;gw;w jd;ik – rq;f ,yf;fpaj;jpy; gfph;jy; mwk; jpUf;Fwspy; Nkyhz;ikf; fUj;Jf;fs; jkpo;f; fhg;gpaq;fs; jkpofj;jpy; rkz ngsj;j rkaq;fspd; jhf;fk; - gf;jp ,yf;fpak;> Mo;thh;fs; kw;Wk; ehad;khh;fs; - rpw;wpyf;fpaq;fs; - jkpopy; etPd ,yf;fpaj;jpd; tsh;r;rp - jkpo; ,yf;fpa tsh;r;rpapy; ghujpahh; kw;Wk; ghujpjhrd; MfpNahhpd; gq;fspg;G.

myF 2	**kuG – ghiw Xtpaq;fs; Kjy; etPd Xtpaq;fs; tiu – rpw;gf; fiy**	**Periods**	**3**

eLfy; Kjy; etPd rpw;gq;fs; tiu – Ik;nghd; rpiyfs; goq;Fbapdh; kw;Wk; mth;fs; jahhpf;Fk; iftpidg; nghUl;fs;> nghk;ikfs; - Njh; nra;Ak; fiy - RLkz; rpw;gq;fs; - ehl;Lg;Gwj; nja;tq;fs; - FkhpKidapy; jpUts;Sth; rpiy - ,irf; fUtpfs; - kpUjq;fk;> giw> tPiz. aho;> ehj];tuk; - jkpoh;fspd; r%f nghUshjhu tho;tpy; Nfhty;fspd; gq;F.

myF 3	**ehl;Lg;Gwf; fiyfs; kw;Wk; tPu tpisahl;Lfs;:**	**Periods**	**3**

njUf;$j;J> fufhl;lk;> tpy;Yg;ghl;L> fzpahd; $j;J> xapyhl;lk;> Njhy;ghitf;$j;J> rpyk;ghl;lk;> tshp> Gypahl;lk;> jkpoh;fspd; tpisahl;Lfs;.

myF 4	**jkpoh;fspd; jpizf; Nfhl;ghLfs;:**	**Periods**	**3**

jkpofj;jpd; jhtuq;fSk;> tpyq;FSk; - njhy;fhg;gpak; kw;Wk; rq;f ,yf;fpaj;jpy; mfk; kw;Wk; Gwf; Nfhl;ghLfs; - jkpoh;fs; Nghw;wpa mwf;Nfhl;ghL - rq;ffhyj;jpy; jkpofj;jpy; vOj;jwpTk;> fy;tpAk; - rq;ffhy efuq;fSk; Jiw Kfq;fSk; - rq;ffhyj;jpy; Vw;Wkjp kw;Wk; ,wf;Fkjp – fly;fle;j ehLfspy; Nrhoh;fspd; ntw;wp.

myF 5	**,e;jpa Njrpa ,af;fk; kw;Wk; ,e;jpa gz;ghl;bw;Fj; jkpoh;fspd; gq;fspg;G:**	**Periods**	**3**

,e;jpa tpLjiyg;Nghhpy; jkpoh;fspd; gq;F - ,e;jpahtpd; gpwg;gFjpfspy; jkpo;g; gz;ghl;bd; jhf;fk; - Rakhpahij ,af;fk; - ,e;jpa kUj;Jtj;jpy;> rpj;j kUj;Jtj;jpd; gq;F – fy;ntl;Lfs;> ifnaOj;Jg;gbfs; - jkpo;g; Gj;jfq;fspd; mr;R tuyhW.

	Total Periods	**15**

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

Programme	B.E./B.TECH	Programme code		Regulation	2019
Department	**CSE,EEE,ECE,IT,BT, BME & CST**		Semester		

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19TN201	□ □ □□ □ □□ □ □ □/ **Heritage of Tamils**	2	0	0	1	40	60	100

Content of the syllabus

UNIT I	**LANGUAGE AND LITERATURE**	**Periods**	**3**

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 Modem literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.

UNIT II	**HERITAGE – ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**Periods**	**3**

Herostone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple carmaking – Massive Terracotta sculptures Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments -Mridhangam, Parai Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

UNIT III	**FOLK AND MARTIAL ARTS**	**Periods**	**3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.

UNIT IV	**THINAI CONCEPT OF TAMILS**	**Periods**	**3**

Flora and Fauna of Tamils & Aham and 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.

UNIT V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**Periods**	**3**

Contribution of Tamils 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.

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Text & Reference Books	
1.	jkpof tuyhW – kf;fSk; gz;ghLk; - Nf.Nf. gps;is (ntspaPL: jkpo;ehL ghlE}y; kw;Wk; fy;tpapay; gzpfs; fofk;).
2.	fzpdpj; jkpo; - Kidth; ,y. Re;juk;. (tpfld; gpuRuk;).
3.	fPob – itif ejpf;fiuapy; rq;ffhy efu ehfhpfk; (njhy;ypay; Jiw ntspaPL)
4.	nghUie - Mw;wq;fiu efhpfk;.(njhy;ypay; Jiw ntaspaPL)
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 Cultur e(Dr.M.Valarmath1) (Published by.International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Pubhs.hed 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.P1llay)
11.	Porunai 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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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
(Autonomous Institution, Affiliated to Anna University, Chennai)
Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19PH208	**Physics Laboratory**	0	0	4	2	60	40	100

Course Objective

The main objective of this course is to:

- Understand elastic behavior of Materials
- Predict viscous force in liquids.
- Gain knowledge in measuring the lowest thickness materials
- Identify wavelengths of prominent lines using polychromatic lamp
- Observe heat conduction in bad conductor
- Understand the principle of interferometer
- Learn about the characteristics of Lasers

Course Outcome	The students who complete this course successfully are expected to	Knowledge Level
	CO1: Measure the young's modulus of the materials, Rigidity modulus – Torsion pendulum	K3
	CO2: Calculate Coefficient of viscosity of liquid and thickness of thin wire using Air wedge	K3
	CO3: Observe and measure the different wavelengths of mercury Spectrum and dispersive power of a prism	K3
	CO4: Illustrate the conductivity of bad conductors. To know how to determine the velocity of ultrasonic waves inliquid	K3
	CO5: To understand the importance of laser beam compared to ordinary light	K2

Pre-requisites ---

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	1													
CO 2	3	3	1	2	2										2
CO 3	3	2			2										
CO 4	3	3		1											1
CO 5	3	1	1		1										

Course Assessment Methods

Direct
1.Prelab and post lab test 2.End-Semester examinations
Indirect
1.Course - end survey

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Experiments	CO
1. Determination of Young's modulus of the material - Uniform bending method.	**CO1**
2. Determination of Young's modulus of the material - Non uniform bending method.	**CO1**
3. Determination of Rigidity modulus – Torsion pendulum.	**CO1**
4. Determination of Coefficient of viscosity of a liquid – Poiseuille's method.	**CO2**
5. Determination of thickness of a thin material – Air wedge method.	**CO2**
6. Determination of wavelength of mercury spectrum – spectrometer grating.	**CO3**
7. Determination of Dispersive power of a prism – Spectrometer.	**CO3**
8. Determination of thermal conductivity of metallic glass using Lee's Disc Method.	**CO4**
9. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.	**CO4**
10. Determination of Wavelength and particle size using Laser.	**CO5**
Total Periods	**45**

Lab Manual

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.

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**II**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19GE203	**Engineering Practices Laboratory**	0	0	4	2	60	40	100

Course Objective	**The main objective of this course is to:** • Know the plumbing line assemblies. • Weld lap joint, butt joint and T-joint. • Learn the assembling and dismantling methodology of home appliances. • Learn the resistor value identification through colors coated on resistor. • Learn the basics of signal generation in CRO. • Learn the soldering techniques in PCB board for designing the projects.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge
	CO1: Perform basic machining operations and finish the job to the requirements and quantify the accuracy.	K2
	CO2: Make various joints such as cross lap joint and Tee lap joint in the carpentry.	K2
	CO3: Understand the basics of house wiring techniques and the measurements of basic electrical quantities.	K2
	CO4: Understand the resistor value identification through colors coated on resistor.	K2
	CO5: Understand the soldering techniques in PCB board for designing the projects.	K2
Pre - requisites	Nil.	

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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**
CO1	3	2	3	2	2	-	-	-	2	-	-	-	2	3	-
CO2	3	2	3	2	2	-	-	-	2	-	-	-	2	-	-
CO3	3	2	2	3	2	2	-	-	2	-	-	-	2	3	-
CO4	3	2	2	3	2	2	-	-	2	-	-	-	2	-	-
CO5	3	2	3	3	2	2	-	-	2	-	-	-	2	-	3

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Course Assessment Methods

Direct
1.Pre lab and Post lab test 2.Record mark 3.End- Semester Examinations
Indirect
1.Course - end survey

GROUP A **(CIVIL & MECHANICAL ENGINEERING)**	
(CIVIL ENGINEERING PRACTICE)	
Plumbing : 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
Carpentry: 3. a) Study of the joints in roofs, doors, windows and furniture.	CO2
b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.	CO2
MECHANICAL ENGINEERING PRACTICE	
1. Welding: a) Preparation of arc welding of butt joints, lap joints and tee joints.	CO1
b) Gas welding practice	CO1
2.Basic Machining: a) Turning and Facing.	CO1
b) Drilling Practice	CO1
3. Sheet Metal Work: a) Forming & Bending	CO1
b) Model making – Tray and Basket.	CO1
4.Demonstration on: (a) Foundry operations like mould preparation for gear and step cone pulley. (b) Fitting – Exercises – Preparation of square fitting and vee – fitting models. **5. Study of Air Conditioner & Centrifugal Pump.**	
GROUP B (ELECTRICAL & ELECTRONICS ENGINEERING) **III. ELECTRICAL ENGINEERING PRACTICE**	
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
IV. ELECTRONICS ENGINEERING PRACTICE	
1. Study of Electronic components and equipments – Resistor, colour coding.	CO4
2. Study of logic gates AND, OR, NOR, NAND and NOT.	CO4

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3. Generation of Clock Signal.		CO4
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.		CO5
	Total Periods	**45**
Reference Books :		
R1.	Dr.P.Kannan, Mr.T.Satheeskumar & Mr.K.Rajasekar, ―Engineering Practices Laboratory‖ Manual. 1st Edition, 2017	
R2.	Mr.T.Jeyapoovan, Mr.M.Saravana Pandian, ―Engineering Practices Lab‖ Manual, Vikas Publishing House Pvt Ltd, 2017.	

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205					
Programme	**B.E.**	Programme code	103	Regulation	2019	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	II	

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MCFY1	**Environmental Science and Engineering**	3	0	0	0	100	0	100

Objective	The main objective of this course is to: • Familiarize basics of ecosystem and creating environmental awareness. • Congregate quality and standards requirement of water. • Contrast water management procedures. • Acquire knowledge on air pollution and its control. • Summarize Solid waste and its prevention methods.	
Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Distinguish the types of Ecosystem and implicit the knowledge.	K1
	CO2: Recognize quality, standard and control strategies of polluted water.	K3
	CO3: Infer and express air pollution and its control.	K3
	CO4: Acquire Knowledge about Radioactive pollution and disposal method	K3
	CO5: Aweraness about population growth, human rights and Environment	K2
Pre-requisites	**Nil**	

CO / PO Mapping
(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**
CO 1	3	1	1			2	3				1	2			
CO 2	1	2	2			2	3					3			
CO 3	2	2	1			3	3				1	2			
CO 4	1	1	1			2	3				1	2	2		
CO 5	1	2	1			2	2				1	3	2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment: simulation using tools 3. End-Semester examinations
Indirect
1. Course – end survey

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	Content of the syllabus		
Unit – I	**Introduction to Environmental Science and Engineering**	Periods	**9**
Nature and scope of environmental education- Natural Resources – (Forest, Water, Food, Energy &Land Resources) problems and remedial measures, 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			
Unit – II	**Water pollution and Waste water treatment process**	Periods	**9**
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.			
Unit – III	**Air Pollution and its Control**	Periods	**9**
Air Pollution – Types of Air pollutants-CO2,SO2, NO2, 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).			
Unit – IV	**Radioactive Pollution and Solid waste management**	Periods	**9**
Radio active 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.			
Unit – V	**Human population and the environment**	Periods	**9**
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 (GIA), Environmental impact Analysis (EIA) and Human health			
		Total Periods	**45**

Text books	
1.	Dr.S. Vairam, “Environment Science and Engineering” Gems publication. Edition 2018
2.	Gilbert.M.Masters-“Environmental Science”-Pearson education. Edition-2-2013
Reference books	
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
E-Resources	
1	https://libraries.ou.edu/
2	https://libguides.reading.ac.uk/
3	https://libguides.reading.ac.uk/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205					
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**III**	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MA303	**Transforms and Partial Differential Equations**	3	1	0	4	40	60	100

Course Objective

The Main Objective of the course is to

- To introduce the basic concepts of PDE for solving standard partial differential equations
- To solve boundary value problems by using Fourier series.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To 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.

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.	K2,K4
CO2: Understand how to solve the given standard partial differential equations**.**	K3,K4
CO3: Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	K3,K5
CO4: 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
CO5: Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.	K1,K3

Pre-requisites: -

CO / PO Mapping (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		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment: Simulation using tool

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3.End-Semester examinations	
Indirect	
1.Course - end survey	

Content of the syllabus

Unit – I	**FOURIER SERIES**	Periods	**12**
Dirichlet's conditions – General Fourier series – Change of interval – Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.			
Unit - II	**PARTIAL DIFFERENTIAL EQUATIONS**	Periods	**12**
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.			
Unit – III	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**	Periods	**12**
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).			
Unit - IV	**FOURIER TRANSFORM**	Periods	**12**
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).			
Unit – V	**Z –TRANSFORM**	Periods	**12**
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.			
		Total Periods	**60**

Text Books

1.	Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.
2.	Churchill, R.V. and Brown, J. W., Fourier series and boundary value problems.(8^{th} Edition), McGraw-Hill, 2011.

References

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 Laplce Transforms", Margham Publishers, 2^{nd} Edition, 1999.
5.	Ray Wylie. C and Barrett.C, " Advanced Engineering Mathematics " Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition ,New Delhi 2012.

E-Resources

1.	https://learnengineering.in
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme code	**103**	Regulation	**2019**			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**III**			
Course code	Course Name	Periods /Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC302	**Electron Devices**	3	0	0	3	40	60	100

Course Objective	• To deliver the knowledge about basics of semiconductor devices • To enhance commanding skillfulness of students through understanding of electronic devices • To introduce and motivate students to use the advanced microelectronic devices • To describes the foundation for forthcoming circuit design courses • To gain knowledge about the technological importance of forthcoming circuit design	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Outline the operation of various diodes and its characteristics	K2
	CO2: Illustrate the operation of Bipolar Junction Transistor and its characteristics	K2
	CO3: Demonstrate the operation of JFET and MOSFET and their characteristics.	K2
	CO4: Extend the operation of semiconductor devices	K3
	CO5: Summarize the operation and characteristics of various power devices and display devices.	K2
Pre-requisites	Basic Electrical and Electronics Engineering	

CO / PO Mapping
(3/2/1 indicates strength of correlation)

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2								1	3		1
CO 2	3	3	2	2								1	3		1
CO 3	3	3	2	2								1	3		1
CO 4	3	2	2	2	1							1	3		1
CO 5	3	2	2	2	1		1					1	3		1

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Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment: Case Studies, Real Time Applications 3.End-Semester examinations
Indirect
1.Course - end survey

Content of the syllabus

Unit – I	**JUNCTION ANALYSIS**	Periods	**9**
PN junction Diode: Basic Structure, Energy Band Diagrams, Zero Applied Bias, Forward Applied Bias, Reverse Applied Bias, PN Junction current, Small signal model of PN junction, Generation and recombination of currents, junction breakdown, Zener Diode: Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator and backward diode, Varactor diode: Working and characteristics, Tunnel diode: V-I Characteristics and working, TED (Transferred Electron Device): Basic concept, Negative differential resistance, V-I Characteristics and working of Gunn Diode, IMPATT: Static and Dynamic Characteristics, Schottky diode: V-I Characteristics and working.			
Unit – II	**BIPOLAR TRANSISTOR**	Periods	**9**
NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE,CB, CC - Hybrid -π model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.			
Unit – III	**FIELD EFFECT TRANSISTORS**	Periods	**9**
JFET: Construction, operation and device characteristics. V-I relationship and transconductance. Small signal equivalent model, frequency limitation factors and cut-off frequency, MOSFET: Two terminal MOS structure, MOSFET construction, Band diagrams under equilibrium and external bias, Threshold Voltage, V-I and CV characteristics, MESFET: Device structure, principle of operation, V-I characteristics, High frequency performance.			
Unit – IV	**OPTICAL DEVICES**	Periods	**9**
Optical absorption: Photon absorption coefficient, EHP generation rate, Solar Cells: The PN junction, Hetero-junction and amorphous silicon solar cells, CCD(charge coupled device), Photo detectors: Photoconductor, photodiode, PIN photodiode, LASER Diode, APD (avalanche photodiode), phototransistor, Opto-couplers: Operation, construction, specifications and applications.			
Unit – V	**POWER DEVICES**	Periods	**9**
PNPN Diode: Basic structure and characteristics, SCR: Basic structure, characteristics, Two transistor analogy. DIAC and TRIAC: Basic Structure and characteristics, GTO: Basic structure and characteristics PUT: Operation and characteristics, UJT: Operation, characteristics, parameters and UJT as a relaxation			
		Total Periods	**45**

TEXT BOOKS:

1. Donald A. Neamen, "Semiconductor Physics and Devices" ,Tata McGraw Hill, Third Edition,2012
2. David Bell, "Electronic Devices and Circuits", Oxford, Fifth Edition,2008

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3. Adel S. Sedra, Kenneth C. Smith and Arun N. Chandorkar, "Microelectronic Circuits", 7th Edition, Oxford University Press, New York, 2017.	
REFERENCES:	
1.	S. M. Sze, "Semiconductor Devices: Physics and Technology", Wiley, Second Edition,2008
2.	Sung-Mo Kang,Yusuf Leblebici, "CMOS Digital Integrated Circuits", Tata McGraw Hill, 3rd Edition,2012
3.	Gordon W. Roberts and Adel S. Sedra, "Spice", Oxford, Second Edition,2011
4.	Streetman and Banerjee, "Semiconductor Physics and Devices", 6th Edition, Pearson prentice Hall, 2006.
5.	Yang, " Fundamental of Semiconductor devices", Tata McGraw Hill, International Edition,2007
E-Resources	
1.	https://www.electronics-tutorials.ws/diode/diode_2.html
2.	https://nptel.ac.in/courses/117102061/
3.	https://www.sciencedirect.com/topics/physics-and-astronomy/optical-device

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**III**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
U19EC303	**Electronic Circuits-I**	3	0	0	3	40	60	100
Course Objective	The student should be made to, • Learn about biasing of BJT and FET/MOSFET circuits • Design amplifiers • Learn about MOSFET amplifiers • Study high frequency response of amplifiers • Study about Power amplifiers							
Course Outcome	At the end of the course, the student should be able to, **CO1:** Choose appropriate biasing circuit for BJT and FET/MOSFET amplifiers **CO2:** Design and analyze amplifiers **CO3:** Design MOSFET amplifiers **CO4:** Exposed to high frequency response of BJT and MOSFET amplifiers **CO5:** Design Power amplifiers							
Pre-requisites	Electron Devices							

CO / PO Mapping (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	2	3	3	3		2							3		2
CO 2	2	3	3	3		2							3		2
CO 3	2	3	3	3		2							3		2
CO 4	2	3	3	3		2							3		2
CO 5	2	3	3	3		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

Content of the syllabus

Unit – I	**BIASING OF BJT AND FET/MOSFET**	Periods	**9**

BJTs:DC load lines, Fixed bias , Emitter bias, Voltage divider bias and Collector feedback configuration, Bias Stabilization, FET/MOSFETs: Fixed bias, Self bias, Voltage divider biasing, Depletion MOSFETs, Enhancement MOSFETs, Design of various biasing methods using BJT/FET/MOSFET, Practical

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applications.			
Unit - II	**BJT AMPLIFIERS**	Periods	**9**
Small Signal r_e model Equivalent circuit of BJT - Analysis of CE, CC and CB amplifiers equivalent circuits - Darlington Amplifier -Bootstrap technique - Cascade, Cascode configurations - Differential amplifier, Small signal analysis and CMRR.			
Unit – III	**MOSFET AMPLIFIERS**	Periods	**9**
Small signal Analysis of amplifiers,Common source amplifier, Source follower and Common Gate amplifiers, Cascode amplifiers, Differential amplifiers,BiMOS Cascode amplifier.			
Unit - IV	**FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS**	Periods	**9**
Low frequency analysis, Miller effect, High frequency analysis of CE, MOSFET CS amplifier and single stage amplifiers, Short circuit current gain, cut off frequency – $f\alpha$, f_β, Unity Gain Bandwidth.			
Unit – V	**POWER AMPLIFIERS**	Periods	**9**
Definitions and Amplifier types, Series Fed Class A amplifier, Transformer Coupled A amplifier, Class B operation and Circuits, Amplifier distortion, Heat sinking, Class C and Class D amplifiers.			
		Total Periods	**45**

Text Books	
1.	Robert L.Boylestad,Louis Nashelssky, "Electronic Devices and Circuit theory", 11th Edition, Pearson, 2015.
2.	Donald .A. Neamen, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill, 2010.
References	
1.	David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5th Edition,2010.
2.	BehzadRazavi, "Design of Analog CMOS Integrated Circuits", Tata Mc Graw Hill, 2007.
3.	Paul Gray, Hurst, Lewis, Meyer, "Analysis and Design of Analog Integrated Circuits", John Willey & Sons, 4th Edition, 2005.
4.	Millman .J. and Halkias C.C, "Integrated Electronics", McGraw Hill, 2001.
5.	D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3rd Edition, 1989.
E-Resources	
1.	https://www.it.iitb.ac.in/nmeict/videoDownloads.html?workshopid=wZgcYNg76npm4W06q15jfA
2.	https://swayam.gov.in/
3.	https://en.wikipedia.org

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**III**

Course code	Course Name	Periods /Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC304	**Digital System Design**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Cram about basic postulates of Boolean algebra and simplification of Boolean expressions to deduce optimal digital Circuits.
- Gain the knowledge of Karnaugh Map Minimization procedures for the analysis and design of combinational circuits and sequential circuits
- Implant the functions and extremity of Sequential Circuits in digital design.
- Evaluate the general notion of asynchronous sequential circuits
- Inculcate the concept of memories and programmable logic devices.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Analyze the Boolean Functions and Boolean Expressions	K4
	CO2: Design the Combinational Circuits using Logic Gates	K3
	CO3: Design the Synchronous Sequential Circuits using Flip Flops	K3
	CO4: Analyze the Asynchronous Sequential Circuits and design Combination and Sequential Circuits using VERILOG	K4
	CO5: Apprehend the Characteristics and structure of different memory systems and Programmable Logic devices	K3

Pre-requisites -

CO / PO Mapping
(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**
CO 1	3	2	2	2	2	-	-	-	-	-	-	3	3	-	2
CO 2	3	3	3	2	2	-	-	-	-	-	-	3	3	-	2
CO 3	3	3	3	2	2	-	-	-	-	-	-	3	3	-	2
CO 4	3	3	3	2	2	-	-	-	-	-	-	3	3	-	2
CO 5	3	2	2	-	2	-	-	-	-	-	-	3	2	-	2

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Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment: Case Studies, Real Time Applications 3.End-Semester examinations
Indirect
1.Course - end survey

Content of the syllabus

Unit – I	**MINIMIZATION TECHNIQUES AND LOGIC GATES**	Periods	**9**

Number Systems - Boolean Postulates and Laws – De-Morgan's Theorem – Principle of Duality – Boolean Expression – Minimization of Boolean Expression - Sum of Products(SOP) – Product of sums(POS) – Karnaugh Map Minimization – Don't Care Conditions – Quine McClusky Method of Minimization.

Logic Gates **(**AND , OR , NOT , NAND , NOR , Exclusive – OR and Exclusive – NOR) – Implementation of Logic Function Using Gates , NAND – NOR Implementations.

Unit – II	**DESIGN OF COMBINATIONAL CIRCUITS**	Periods	**9**

Design Procedure –Design of Adder, Subtractor, Binary Multiplier, Muliplexer /Demultiplexer, Decoder, Encoder, Parity Checker, Parity Generators, Code Converters, Magnitude Comparator.

Unit – III	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	Periods	**9**

Sequential Logic Elements-Latches, Flip-Flops, Registers, Counters, State Diagram -State Table – State Minimization - State Assignment – Excitation Table and Maps – Design and Analysis of Synchronous Sequential Circuits

Unit – IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	Periods	**9**

Design of Fundamental Mode and Pulse Mode Circuits – Incompletely Specified State Machine – Problems in Asynchronous Circuits – Design of Hazard Free Switching Circuits. Design of Combinational and Sequential circuits using VERILOG.

Unit – V	**MEMORIES AND PROGRAMMABLE LOGIC DEVICES**	Periods	**9**

Classification of Memories – ROM – ROM Organization – PROM - EPROM – EEPROM , RAM – RAM Organization – Write Operation –Read Operation – Memory Cycle – Timing Wave Forms – Memory Decoding – Memory Expansion – Static and Dynamic RAM– Programmable Logic Devices – Programmable Logic Array(PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays(FPGA) – Implementation of Combinational Logic Circuits Using ROM, PLA, PAL.

	Total Periods	**45**

TEXT BOOKS:

1.	M.MorrisMano, Digital Design, 3rd Edition, Prentice Hall of India Pvt.Ltd.,2003/ Pearson Education (Singapore) Pvt.Ltd., NewDelhi, 2018.
2.	JohnF.Wakerly, Digital Design,Fourth Edition,Pearson /PHI,2016

REFERENCES:

1.	John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
2.	Charles H.Roth. Fundamentals of Logic Design, Thomson Learning, 2004.

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3.	William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
4.	Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2005
5.	Donald D. Givone, Digital Principles and Design, TMH, 2016.
E-Resources	
1.	http://osp.mans.edu.eg/cs212/Seq_circuits_design.htm
2.	https://www.electronics-tutorials.ws/combination/comb_1.html
3.	https://www.geeksforgeeks.org/difference-between-synchronous-and-asynchronous-sequential-circuits/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC305	**Signals and Systems**	3	0	0	3	40	60	100

Course Objective

The student should be made ,

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To introduce visualization and mathematical representation of continuous-time and discrete-time signals.
- To teach the applications of Laplace and Fourier transforms in the analysis of continuous time signals.
- To teach the applications of Z- and Fourier transforms in the analysis of discrete –time signals
- To develop the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.	K4
	CO2: Classify systems based on their properties and determine the response of LSI system using convolution.	K3
	CO3: Analyze system properties based on impulse response and Fourier analysis.	K4
	CO4: Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.	K4
	CO5: Understand the process of sampling and the effects of under sampling.	K3
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation)

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	1	2
CO 2	3	2	3										3	1	2
CO 3	3	2	2	2									3	1	2
CO 4	3	2											3	1	2

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CO 5	3	2	3	2								3	1	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III **2.** Assignment: Simulation using tool **3.** End-Semester examinations
1. Course - end survey **(student participation, placement details can also be included as an indirect tool)**

Content of the syllabus

Unit – I	**CLASSIFICATION OF SIGNALS AND SYSTEMS**	Periods	**9**
Continuous Time Signals(CT Signals), Discrete Time Signals(DT Signals) – Step ,Ramp, Pulse, impulse, Exponential, Classification of CT and DT Signals – Periodic and Aperiodic , Random Signals , CT Systems and DT Systems , Basic Properties of Systems – Linear Time Invariant Systems and Properties.			
Unit - II	**ANALYSIS OF CONTINUOUS TIME SIGNALS**	Periods	**9**
Fourier Series Analysis – Spectrum of Continuous Time Signals, Fourier Transform and Laplace Transform in Signal Analysis.			
Unit – III	**LINEAR TIME INVARIANT -CONTINUOUS TIME SYSTEMS**	Periods	**9**
Differential Equation , Block diagram representation , Impulse Response , Convolution integral , Frequency Response , Fourier and Laplace Transforms in Analysis , State Variable Equations and Matrix Representation of Systems.			
Unit - IV	**ANALYSIS OF DISCRETE TIME SIGNALS**	Periods	**9**
Sampling of CT Signals and Aliasing, DTFT and Properties, Z-Transform and Properties of Z-Transform.			
Unit – V	**LINEAR TIME INVARIANT – DISCRETE TIME SYSTEMS**	Periods	**9**
Difference Equations , Block Diagram Representation , Impulse Response , Convolution Sum , LTI Systems Analysis Using DTFT and Z-Transforms , State Variable Equations and Matrix Representation of Systems.			
		Total Periods	**45**

Text Books

1.	Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007.
2.	Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons, Inc, 2004.

References

1.	Robert A. Gabel and Richard A.Roberts, “Signals & Linear Systems”, John Wiley, 3rd Edition, 1987.
2.	Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. “Signals & systems”, 4th Edition, Pearson Education, 2002.
3.	Edward W Kamen & Bonnie’s Heck, “Fundamentals of Signals and Systems”, Pearson Education, 2007.
4.	B. P. Lathi, "Principles of Linear Systems and Signals", Oxford, 2nd Edition, 2009.
5.	S. Haykin and B. Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2003.

E-Resources

1.	https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
2.	https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/assignments/
3.	http://www.eng.ucy.ac.cy/cpitris/courses/ece623/notes/SignalsAndSystems.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**104**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19CS304	**Data Structures**	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Impart the basic concept of list ADT. • Learn the linear data structures such as stack and queue. • Describe the non linear data structures such as Tree and Graphs. • Examine various algorithms for finding shortest path and minimum spanning tree. • Analyze various searching, sorting algorithms and hashing techniques.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Implement abstract data type for list and operations	K3
	CO2: Apply the stack and queue data structure for problem solution	K3
	CO3: Analyze various tree data structures to implement various applications	K4
	CO4: Critically analyze and solve the problems in finding shortest path and minimum spanning	K4
	CO5: Demonstrate the various searching, sorting algorithms and hashing techniques	K2
Pre-requisites	-	

CO / PO Mapping (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	3									2	2	2	
CO 2	3	3	3									2	2	2	
CO 3	3	3	3									2	2	3	
CO 4	3	3	3									2	2	3	
CO 5	3	3	3									2	2	3	

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

Content of the syllabus

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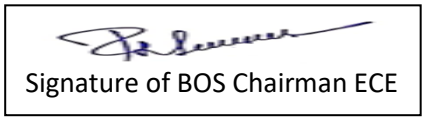
Unit – I	LINEAR DATA STRUCTURE – LIST	Periods	9
Abstract Data Types (ADTs) – List ADT – Array Implementation – Linked List Implementation — Singly Linked Lists – Circular Linked Lists – Doubly Linked Lists – Applications of Lists – Polynomial operations (Insertion, Deletion, Merge, Traversal).			
Unit - II	**LINEAR DATA STRUCTURE – STACKS, QUEUES**	Periods	**9**
Stack ADT – Operations – Application: Evaluating Arithmetic Expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – DeQueue – Applications of queues.			
Unit – III	**NON LINEAR DATA STRUCTURE – TREES**	Periods	**9**
Terminologies – Tree ADT – Binary Tree – Tree Traversals – Expression Trees – Applications of Trees – Binary Search Tree ADT - AVL Trees – B- Trees – Heap – Applications of Heap.			
Unit - IV	**NON LINEAR DATA STRUCTURES – GRAPHS**	Periods	**9**
Definition – Representation of Graph – Types of graph – Breadth-First Traversal – Depth-First Traversal – Topological Sort – Shortest Path Algorithms - Minimum Spanning Tree - Applications of graphs.			
Unit – V	**SEARCHING, SORTING & HASHING TECHNIQUES**	Periods	**9**
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.			
		Total Periods	**45**

Text Books	
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
References	
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.
E-Resources	
1.	https://www.edx.org/course/algorithms-and-data-structures
2.	https://hackr.io/tutorials/learn-data-structures-algorithms
3.	https://www.learneroo.com/subjects/8



	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E/B.TECH**	**Programme code**		**Regulation**	**2019**
Department	**CSE,EEE,ECE,IT,BT,BME & CST**		Semester		

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19TA302	[illegible] [illegible] ;;/ [illegible] **TAMILS AND TECHNOLOGY**	2	0	0	1	40	60	100

Content of the syllabus

myF 1	[illegible]	**Periods**	**3**

[illegible]

myF 2	[illegible]	**Periods**	**3**

[illegible]

myF 3	[illegible]	**Periods**	**3**

[illegible]

myF 4	[illegible]	**Periods**	**3**

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myF 5		**Periods**	**3**
		Total Periods	**15**

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Elayampalayam, Tiruchengode – 637 205

Programme	B.E/B.TECH	**Programme code**		**Regulation**	2019
Department	**CSE,EEE,ECE,IT,BT,BME & CST**		**Semester**		

Course code	**Course name**	**Periods per week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**ESE**	**Total**
U19TA302	□ □/ TAMILS AND TECHNOLOGY	2	0	0	1	40	60	100

Content of the syllabus

UNIT I	**WEAVING AND CERAMIC TECHNOLOGY**	**Periods**	**3**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.			
UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**Periods**	**3**
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 Nayakkar Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.			
UNIT Ill	**MANUFACTURING TECHNOLOGY**	**Periods**	**3**
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			
UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**Periods**	**3**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu 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.			
UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**Periods**	**3**
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.			

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Text cum-Reference Books	
1	jkpof tuyhW – kf;fSk; gz;ghLk; - Nf.Nf. gps;is (ntspaPL: jkpo;ehL ghlE}y; kw;Wk; fy;tpapay; gzpfs; fofk;).
2	fzpdpj; jkpo; - Kidth; ,y. Re;juk;. (tpfld; gpuRuk;).
3	fPob – itif ejpf;fiuapy; rq;ffhy efu ehfhpfk; (njhy;ypay; Jiw ntspaPL)
4	nghUie -Mw;wq;fiu ehfhpfk;.(njhy;ypay; Jiw ntaspaPL)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint pubhcation 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.P1llay)
11	Porunai 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.

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC306	**Digital System Design Laboratory**	0	0	2	1	60	40	100

Course Objective	• To design digital logic and circuits and learn the function of different ICs • To introduce Boolean algebra and its applications in digital systems • To understand the design and functionality of combinational and sequential circuits • To simulate basic combinational and sequential circuits using Hardware Description Language HDL	
Course Outcomes	At the end of the course, the student should be able to	Knowledge Level
	CO1: Simplify complex Boolean functions	K1
	CO2: Implement digital circuits using combinational logic ICs and PLDs.	K3
	CO3: Understand the characteristics of various Flip-Flops	K2
	CO4: Design digital circuits with combinational and sequential components	K6
	CO5: Use HDL to build digital systems	K3

CO / PO Mapping (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	2	1	1				1		1	2	3	2	1
CO 2	3	2	2	1	1				1		1	1	3	2	1
CO 3	3	2	2	1	1				1		1	1	1	3	3
CO 4	3	2	2	1	1				1		1	1	1	1	1
CO 5	3	2	2	1	1				1		1	1	2	1	1

Course Assessment Methods

Direct
1.Pre lab and Post lab 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Suggested list of experiments

Design and verification of truth table using digital IC's

	Course Outcome
1. Universal gates.	CO1

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2.	Arithmetic circuits using logic gates	CO1
3.	Combinational Circuits (Adder, Subtractor).	CO2
4.	Code Converters (Gray to Binary & Binary to Gray).	CO2
5.	2bit magnitude comparator using logic gates.	CO4
6.	Odd/Even parity checker and generator using IC74180.	CO4
7.	Multiplexer and De-multiplexer.	CO4
8.	Encoder and Decoder using logic gates.	CO4
9.	Data transfer using Shift register.	CO3,CO4
10.	Synchronous and ripple counter using logic gates.	CO4
	Total Periods	**45**

Text Books	
1.	M. Morris Mano and Michael D. Ciletti, ―Digital Design‖, 5th Edition, Pearson, 2013.
2.	Charles H. Roth, Jr, ―Fundamentals of Logic Design‖, Fourth edition, Jaico Books, 2002.
References	
1.	William I. Fletcher, ―An Engineering Approach to Digital Design‖, Prentice- Hall of India, 1980.
2.	Floyd T.L., ―Digital Fundamentals‖, Charles E. Merril publishing company, 1982.
3.	John. F. Wakerly, ―Digital Design principles and practices‖, Pearson Education, Fourth Edition, 2007.
4.	Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, 2003
5.	G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.
E-Resources	
1.	https://www.scribd.com/document/290062622/Digital-Electronics-Lab-Viva-Questions
2.	https://www.javatpoint.com/digital-electronics-interview-questions
3.	https://www.electronicshub.org/electronics-mini-projects-ideas/

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Programme	**B.E.**	Programme code	**103**	Regulation	**2019**			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**III**			
Course code	Course Name	Periods /Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC307	**Electron Devices and Circuits Laboratory**	0	0	2	1	60	40	100

Course Objective

- To learn the characteristics of basic electronic devices such as Diode, BJT,FET, SCR
- To design and analyze BJT configurations
- To learn hardware implementation and testing of analog circuits
- To design amplifier circuits to meet desired specifications
- To simulate various electronic circuits using P-SPICE software

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Demonstrate V-I characteristics of PN junction diode & Zener diode	K2
	CO2: Illustrate the operation of BJT and its Characteristics	K2
	CO3: Design, build and test any analog circuits for handling real life projects	K3
	CO4: Exposed to circuit simulations using present meter technology MOSFETs	K4
	CO5: Apply P-spice & Develop a working model of an electronic circuit	K3

Pre-requisites U19EE201 Basic Electrical and Electronics Engineering

COs Vs POs & PSOs
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

SUB.CODE & NAME	**ELECTRON DEVICES AND CIRCUITS LABORATORY**														
COURSE OUTCOME	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	2										2		
CO2	2	1	2										2		
CO3	2	1	2										2		
CO4	2	1	2										2		
CO5	2	1	2										2		

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Course Assessment Methods

Direct
1.Pre lab and Post lab 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

	List of Experiments	**Course Outcome**
1.	Characteristics of PN Junction Diode	CO1
2.	Zener diode Characteristics & Regulator using Zener diode	CO1
3.	Common Emitter input-output Characteristics	CO2
4.	FET Characteristics	CO4
5.	SCR Characteristics	CO3
6.	Frequency Response of CE amplifier and its Spice simulation	CO5
7.	Design of CC Amplifier for a specific output impedance and its Spice Simulation	CO5
8.	Spice simulation of CS, CG, and CD configuration of MOSFET amplifiers with various	CO4
9.	Design of Differential Amplifiers and its CMRR measurement	CO3
10.	Design and analysis class A power amplifier	CO3
	Total Periods	**45**

Suggested Lab Manuals:

1. David A. Bell, " Laboratory manual for Electronic Devices and Circuits", PHI, 4th Edition,2001

E-Resources

1.	https://www.electronics-tutorials.ws/diode/diode_2.html
2.	https://nptel.ac.in/courses/117102061/
3.	https://www.sciencedirect.com/topics/physics-and-astronomy/optical-device

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Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19CS308	**Data Structures Laboratory**	0	0	4	2	60	40	100

Course Objective

The student should be made to,

- Design and develop simple programs using data structures
- Apply linear data structures for various real time applications.
- Develop programs to implement non linear data structures.
- Design shortest path algorithm for various real life applications
- Write programs to implement for sorting and hashing.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Design and implement program for Linked List	K6
CO2: Implementing the program for manipulating Stack	K2
CO3: Design and Implement programs for Binary Search tree and AVL tree	K6
CO4: Implement the shortest path algorithms available in graph	K2
CO5: Apply appropriate sorting algorithm and hash functions that result in a collision free scenario for data storage and retrieval	K3

Pre-requisites: -

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	3									2	2		
CO 2	3	3	3									2	2		
CO 3	3	3	3									2	2		
CO 4	3	3	3									2	2		
CO 5	3	3	3									2	2		

Course Assessment Methods

Direct
1. Prelab and post lab test **2.** End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

SUGGESTED LIST OF EXPERIMENTS:

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LIST OF EXPERIMENTS	Course Outcome
1. Represent a polynomial as a linked list and write functions for polynomial addition.	CO1
2. Implementation of stack and use it to convert infix to postfix expression.	CO2
3. Implementation of Binary Tree and Traversal Techniques	CO2
4. Implementation of binary search tree	CO3
5. Implementation of insertion in AVL trees.	CO3
6. Implementation of graphs using BFS and DFS.	CO4
7. Implementation of Djikstra‘s algorithm.	CO4
8. Implementation of Prim‘s algorithm using priority queue to find MST of an undirected graph.	CO4
9. Implementation of Merge sort using Divide and Conquer method.	CO5
10. Implementation of Hashing with open addressing	CO5
Total Periods	**45**

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**IV**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MA407	**Probability and Random Processes**	3	1	0	4	40	60	100

Course Objective

The main objective of the course is to

- Know and differentiate between discrete and continuous random variables.
- Proficiently understand the expected value, variance, and higher-order moments of random variables (for both discrete and continuous types).
- Understand means, correlations/ covariances of random processes.
- Identify relationship between wiener-Khintchine relation and spectral densities.
- Evaluate the response of a linear system to stationary processes.

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Translate the density and distribution functions for discrete and continuous variables.	K1,K3
CO2: Use the central limit theorem to compute probabilities.	K2,K3
CO3: Recognize the Random processes is WSS and whether the two random processes are jointly WSS.	K1,K5
CO4: Compute the autocorrelation function and the power spectral density function of a wide-sense stationary process.	K2,K5
CO5: Analyze the response of random inputs to linear time invariant systems.	K2,K4

Pre-requisites

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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		

Course Assessment Methods

Direct

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

Content of the syllabus

Unit – I	**RANDOM VARIABLES**	Periods	**12**
Discrete and continuous random variables – Moments - Moment generating functions and their properties. Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions			
Unit - II	**TWO DIMENSIONAL RANDOM VARIBLES**	Periods	**12**
Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression(for two dimensional random variables) - Central limit theorem			
Unit – III	**CLASSIFICATION OF RANDOM PROCESSES**	Periods	**12**
Definition and examples - first order, second order, strictly stationary, auto correlation and its properties , wide-sense stationary and ergodic processes - Markov process - Poisson and Normal processes.			
Unit - IV	**CORRELATION AND SPECTRAL DENSITIES**	Periods	**12**
Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function			
Unit – V	**LINEAR SYSTEMS WITH RANDOM INPUTS**	Periods	**12**
Linear time invariant system - System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output – white noise.			
		Total Periods	**60**

Text Books

1.	Ibe, O.C., Fundamentals of Applied probability and Random processes, Elsevier, 2007
2.	Peebles Jr. P.Z., Probability Random Variables and Random Signal Principles, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2015.

References

1.	Miller,S.L and Childers, S.L, Probability and Random Processes with applications to Signal Processing and Communications, Elsevier Inc., First Indian Reprint 2007.
2.	Stark, H. and Woods, J.W., Probability and Random Processes with Applications to Signal Processing, Pearson Education (Asia), 3rd Edition, 2009.
3.	Papoulis, A. and Pillai, S.U., Probability, Random Variables and Stochastic Processes, 4th Edition, McGraw Hill, 2002.
4.	Hwei Hsu, H. "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw-Hill edition, New Delhi, 2012.
5.	Leon-Garcia, A, "Probability and Random Processes for Electrical Engineering", Pearson Education Asia, Second Edition, 2011.

E-Resources

1.	https://www.maths.ed.ac.uk
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**IV**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC410	**Electronic Circuits-II**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- To study about feedback amplifiers and oscillator principles
- To design oscillators
- To study about tuned amplifiers
- To design shaping and Multivibrator circuits
- To know about blocking Oscillator & Time base Circuits.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Acquire knowledge about feedback amplifiers	K1
CO2: Design the oscillator circuits	K6
CO3: Acquire knowledge about tuned amplifiers	K1
CO4: Design and construct Wave shaping and Multivibrator circuits	K6
CO5: Design and construct Blocking Oscillators and Time base Circuits.	K6

Pre-requisites: **Electronic Circuits-I**

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	3	3	3		2							3		2
CO 2	2	3	3	3		2							3		2
CO 3	2	3	3	3		2							3		2
CO 4	2	3	3	3		2							3		2
CO 5	2	3	3	3		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

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Content of the syllabus			
Unit – I	**FEEDBACK AMPLIFIERS AND STABILITY**	Periods	**9**
Basic feedback concepts –The Transfer gain with feedback-General characteristics of feedback-input resistance-output resistance – Four feedback topologies– Analysis of series–shunt, series-series, shunt-shunt and shunt-series feedback amplifiers – Stability of Feedback amplifiers.			
Unit - II	**OSCILLATORS**	Periods	**9**
Barkhausen criteria for oscillator – Analysis of RC oscillators – Phase shift and Wein bridge oscillators – LC oscillators – Colpitts, Hartley, Clapp, and Ring Oscillators.			
Unit – III	**TUNED AMPLIFIERS**	Periods	**9**
Basic principles – Inductor losses – Use of transformers – Single tuned amplifier frequency analysis - Multiple tuned circuits – Stagger tuning– Stability of tuned amplifiers using Neutralization techniques.			
Unit - IV	**WAVE SHAPING AND MULTIVIBRATOR CIRCUITS**	Periods	**9**
Waveform shaping circuits- diode Clippers- diode Clampers-Multivibrators-Astable Multivibrator-Monostable Multivibrator- Bistable Multivibrator-Schmitt Trigger- UJT Oscillator.			
Unit – V	**BLOCKING OSCILLATORS AND TIME BASE GENERATORS**	Periods	**9**
UJT Relaxation Oscillator, Pulse transformers, Free running blocking oscillator, Triggered blocking oscillators, Time base circuits, Linearization through adjustment of driving waveform.			
		Total Periods	**45**

Text Books	
1.	S.Salivahanan,N.Suresh Kumar,A.Vallavaraj,'Electroni Devices and Circuits', McGraw Hill, 14th Edition, Reprinted, 2017.
2.	Jacob Millman, 'Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009.
References	
1.	Donald .A. Neamen, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill, 2010.
2.	Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", 7th Edition, Oxford University Press, 2014.
3.	David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5th Edition,2010.
4.	BehzadRazavi, "Design of Analog CMOS Integrated Circuits", Tata Mc Graw Hill, 2007.
5.	D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3rd Edition, 1989.
E-Resources	
1.	https://www.it.iitb.ac.in/nmeict/videoDownloads.html?workshopid=wZgcYNg76npm4W06q15jfA
2.	https://swayam.gov.in/
3.	https://en.wikipedia.org/

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Programme	**B.E**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**IV**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC411	**Digital Signal Processing**	3	1	0	4	40	60	100

Course Objective	The student should be made to, • To learn Discrete Fourier transform and Fast Fourier Transform. • To know the characteristics of IIR filters and learn methods to design IIR filters. • To know the characteristics of FIR filters and learn methods to design FIR filters. • To study the effects of finite word length effects. • To study about Digital Signal Processor and Multirate signal Processing.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Analyze Discrete Fourier transform and Fast Fourier Transform.	K4
	CO2: Design and Realize Infinite Impulse Response filters.	K4
	CO3: Design and Realize Finite Impulse Response filters.	K4
	CO4: Analyze the effects of finite word length effects	K4
	CO5: Understand the architecture and programming of DSP processors and analyze Multirate signal processing.	K4
Pre-requisites	Signal and Systems	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	3	3									3	3	2
CO 2	3	3	3	3									3	3	2
CO 3	3	3	3	3									3	3	2
CO 4	3	3	3	3									3	3	2
CO 5	3	3	3	3									3	3	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment: Simulation using tool **(Not only assignment it can be GD, Seminar, Quiz etc.,)** 3. End-Semester examinations
Indirect
1. Course - end survey **(student participation, placement details can also be included as an indirect tool)**

Content of the syllabus

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Unit – I	**DISCRETE FOURIER TRANSFORM**	Periods	**9+3**
Review of discrete-time signals & systems, Discrete Fourier Transform : Properties , Inverse DFT , Circular Convolution, Fast Fourier Transform: Radix-2 FFT, Decimation-in-time and Decimation-in-frequency algorithms & its applications ,Overlap-add & overlap-save methods.			
Unit - II	**INFINITE IMPULSE RESPONSE FILTERS**	Periods	**9+3**
Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.			
Unit – III	**FINITE IMPULSE RESPONSE FILTERS**	Periods	**9+3**
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.			
Unit - IV	**FINITE WORD LENGTH EFFECTS**	Periods	**9+3**
Representation of numbers-ADC Quantization noise, derivation for quantization noise power, over flow error, co-efficient quantization error, Product Quantization error-truncation & rounding errors, limit cycle oscillation.			
Unit – V	**DIGITAL SIGNAL PROCESSORS & MULTIRATE SIGNAL PROCCESSING**	Periods	**9+3**
DSP functionalities - Circular buffering – Pipelining - DSP architecture – Fixed (C5X)and Floating point(C54X) architecture principles – addressing modes - Simple programming examples. Mathematical description of change of sampling rate, Interpolation and Decimation, Decimation by an integer factor, Interpolation by an integer factor, - Sampling rate conversion by a rational factor.			
		Total Periods	**60**

Text Books	
1.	John G. Proakis & Dimitris G.Manolakis, ―Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007.(Unit I – IV)
2.	B.Venkataramani & M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application", TMH 2002.(Unit V)
References	
1.	Emmanuel C. Ifeachor & Barrie. W. Jervis, ―Digital Signal Processing‖, Second Edition, Pearson Education / Prentice Hall, 2002.
2.	Alan V Oppenheim, Ronald W Schafer, John R Buck, "Discrete Time Signal Processing",Pearson,2009.
3.	Sanjit K. Mitra, ―Digital Signal Processing – A Computer Based Approach‖, Tata Mc Graw Hill, 2007.
4.	Andreas Antoniou, ―Digital Signal Processing‖, Tata Mc Graw Hill, 2006.
E-Resources	
1.	https://nptel.ac.in/courses/117102060/
2.	https://en.wikipedia.org/wiki/Digital_signal_processing

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Programme	**B.E**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**IV**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC412	**Electromagnetic Fields**	3	0	0	3	40	60	100

Course Objective	The main objective of this course is • To recall and learn the fundamentals to study about electromagnetic fields • To learn about the static electric charges ,laws and field concepts • To learn about the material mediums and its properties along with fileds. . • To learn about the static magnetic fields concepts and laws . • To learn the Maxwell's equations, electromagnetic waves and propagation	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: understand and solve basicmathematical problems relavent to electromagnetics.	K2
	CO2: Interpret knowledge on the basics of static electric and magnetic field and the associated laws.	K3
	CO3: Explain the behavior of electric and magnetic fields in the presence of dielectrics and magnetic materials.	K3
	CO4: Apply the propagation of EM waves and also get introduced to the methods in computational electromagnetic.	K4
	CO5: Analyze Electromagnetic wave propagation.	K4
Pre-requisites	Vector algebra,Differential and Integral calculus	

CO / PO Mapping (3/2/1 indicates strength of correlation)													**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	3	3									3	1	2
CO 2	3	3	2	3									3	1	2
CO 3	3	3	2	3									3	1	2
CO 4	3	2	2	2	2								3	1	2
CO 5	3	2	1	2									3	1	2

Course Assessment Methods

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

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1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**
Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems- Line, surface and volume integrals- Divergence theorem , Stoke's theorem- Gradient, Divergence ,Curl and its physical interpretation, , Null identities, Helmholtz's theorem.			
Unit - II	**ELECTRO STATICS**	Periods	**9**
Coulomb's Law and Field Intensity , Electric Fields due to Continuous Charge Distributions , Electric Flux Density , Gauss's Law – Maxwell's Equation – Applications of Gauss's Law – Electric Potential , Energy Density in Electrostatic Fields.			
Unit – III	**ELECTRIC FIELDS IN MATERIAL SPACE**	Periods	**9**
Properties of Materials – Convection and Conduction Currents – Current Continuity Equation and Relaxation Time , Displacement Current , Maxwell's Equations and Boundary Conditions – Poisson's and Laplace's Equations.			
Unit - IV	**MAGNETO STATICS**	Periods	**9**
Biot-savart's Law, Ampere's Circuit Law – Maxwell's Equation, Applications of Ampere's Law. Magnetic Flux Density – Maxwell's Equation, Maxwell's Equations for Static Fields, Magnetic Scalar and Vector Potentials.			
Unit – V	**ELECTROMAGNETIC WAVE PROPAGATION**	Periods	**9**
Maxwell's Equation in Final Form – Wave Propagation in Lossy Dielectrics , Plane Waves in : Lossless Dielectrics , Free Space and Good Conductors , Power and the Poynting Vector , Reflection of a Plane Wave at : Normal Incidence and Oblique Incidence.			
		Total Periods	**45**

Text Books

1.	Sadiku, M.N.O., "Elements of Electromagnetics", 3rd Edition, Oxford University Press. 2001.
2.	Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice-Hall of India. 1993.

References

1.	Narayana Rao, N., "Elements of Engineering Electromagnetic", 6th Edition, Prentice-Hall of India.2002.
2.	Hayt, W.H. and Buck, J.A., "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill. 2012.
3.	Kraus, J.D. and Fleisch, D.A., "Electromagnetics with Applications", McGraw-Hill. 2010.
4.	Ramo, S.A., Whinnery, J.R. and Van Duzer, T., "Fields and Waves in Communication Electronics", 3rd Edition, John Wiley & Sons. 1994.
5.	D.K. Cheng, "Field and Wave Electro Magnetics", Pearson (India), 2nd edition ,1989.

E-Resources

1.	http://en.wikipedia.org/wiki/Electrostatics.
2.	http://alphard.ethz.ch/hafner/vorles/physicalMOD/chapter1.pdf.
3.	http://www.Maxwells-equations.com/density/electric-flux.php.

Signature of BOS Chairman ECE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**IV**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC413	**Linear Integrated Circuits**	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Illustrate the concept of Monolithic IC fabrication technique and characteristics Op-amp. • Interpret the various applications of Op-amp. • Understand the function of Analog Multiplier and the applications of PLL circuits. • Categorize the ADCs and DACs with the applications. • Elaborate the concept of various waveform generation and regulator circuits.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Describe about Monolithic IC fabrication technique and compare the characteristics various Op-amp based ICs.	K2
	CO2: Demonstrate the various applications of Op-amp.	K2
	CO3: Analyze the functional blocks and the applications of PLL circuits.	K4
	CO4: Examine the operation of ADCs and DACs.	K3
	CO5: Define the internal circuits of waveform generation and regulator circuits.	K3
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 – Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	2	2			2		2	3	2	
CO 2	2		2			2	2		2	2		2	2	2	
CO 3	3		3			3	2		2	2			3		2
CO 4	2			2		2	2		2	2		2	3		2
CO 5	2		2			2	2		2	2		2	2	2	

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III. 2. Assignment: Simulation using tool, Quiz and Seminar. 3. End-Semester examinations.
Indirect
1. Course - end survey.

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Content of the syllabus

Unit – I	**INTRODUCTION TO LINEAR IC**	Periods	**9**

Advantages of ICs over discrete components-Manufacturing process of monolithic ICs-Characteristics of Ideal and Practical Operational amplifier - Parameters of Operational amplifier- Inverting and Non inverting amplifier configurations, General operational amplifier stages and Internal circuit diagrams of IC 741, DC and AC performance characteristics-Slew rate-Open and Closed Loop configurations.

Unit – II	**APPLICATIONS OF OPERATIONAL AMPLIFIER**	Periods	**9**

Adder-Difference Amplifier-Differentiator-Integrator-Voltage Follower-Voltage to Current, Current to Voltage converters-Instrumentation amplifier-Logarithmic amplifier-Phase Shift Circuits-Comparator-Schmitt trigger-Precision rectifier- Clipper and Clamper- Low Pass and High Pass Butterworth filters.

Unit – III	**ANALOG MULTIPLIER AND PLL**	Periods	**9**

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell - Analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage Controlled Oscillator, Monolithic PLL IC 565, Application of PLL.

Unit – IV	**A-D AND D-A CONVERTER**	Periods	**9**

Analog and Digital Data Conversions, D/A converter – Specifications - Weighted resistor type, R-2R Ladder type, Voltage Mode and Current Mode, R-2R Ladder types - Switches for D/A converters, IC DAC-08, A/D Converters –Specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - Conversion Times of typical IC ADC.

Unit – V	**WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs**	Periods	**9**

Sine wave generators, Multivibrators and Triangular wave generator, Saw tooth wave generator-Timer IC 555-IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Frequency to Voltage and Voltage to Frequency Converters - Audio Power amplifier - Video Amplifier - Isolation Amplifier - Opto couplers and Fibre optic IC.

Total Periods	45

Text Books

1.	Seringo Franco, “Design with operational amplifiers and analog Integrated Circuits”, Fourth Edition McGraw-Hill Education - Europe, 2014.
2.	D. Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, Fourth Edition, New Age International Pvt. Ltd., 2011.

References

1.	B.S.Sonde, “System design using Integrated Circuits”, New Age Publication, Second Edition, 2011,
2.	Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, Fifth Edition, 2010.
3.	Ramakant A.Gayakwad, “OP-AMP and Linear ICs”, Prentice Hall / Pearson Education, Fourth Edition, 2012.
4.	J.Michael Jacob, “Applications and Design with Analog Integrated Circuits”, Prentice Hall of India, Second Edition, 2009.
5.	William D.Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 2014.
6.	K.Lal Kishore, “Operational Amplifier and Linear Integrated Circuits”, Pearson Education; First edition, 2012.
7.	G B Clayton ,Steve Winder, “Operational Amplifiers”, Fifth Edition, Elsevier science, 2003.

E-Resources

1.	https://www.tutorialspoint.com/linear_integrated_circuits_applications/basics_of_linear_integrated_circuits_applications.htm

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2.	https://www.google.com/search?biw=1280&bih=609&sxsrf=ACYBGNR4y8KbShS2jrEhlInQ_dcginKWYw%3A1573192577727&ei=gQPFXZbxK4-WwgPFm6zYCQ&q=linear+integrated+circuits+by+roy+choudhary&oq=linear+integrated+circuiT+&gs_l=psy-ab.1.9.35i305i39l2j0i10l8.19232.23470..28872...0.3..0.1507.4634.0j2j1j0j1j1j0j1j1.....0....1..gws-wiz.....0i71j35i39j0j0i20i263.WTwHuOjzWY4
3.	https://www.chegg.com/tutors/what-are-Linear-Integrated-Circuits/
4.	https://www.brainkart.com/article/Important-Questions-and-Answers--Linear-Integrated-Circuits---Analog-to-Digital-(ADC)-And-Digital-to-Analog-(DAC)-Converters_36043/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**IV**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC414	**Measurements and Instrumentation**	3	0	0	3	40	60	100

Course Objective

- To understand the internal structure of all instruments that are used in measuring parameters related to electronics and also difference between analog meters and digital meters and their performance characteristics.
- To analyze the concept of measurement and the related instrumentation requirement.
- To Study about the Importance of signal generators and signal analyzers in measurements.
- To Study about the Concepts of electronic measurements through indication and displaying.
- To emphasize the need for data acquisition systems and optical domain measurement techniques about digital instruments.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Discuss about the principles of various measurement techniques	K6
	CO2: Identify various transducers to measure strain, temperature and displacement	K4
	CO3: Explain about the signal conditioning system and signal analyzers	K2
	CO4: Apply knowledge of instruments for effective use	K3
	CO5: Understand data acquisition system and general purpose interfacing bus	K1

CO / PO Mapping
(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	2	1									3	2	1
CO 2	3	2	2	1	1								3	2	1
CO 3	3	3	2	1			2					1	1	3	3
CO 4	3	2	1	1	3								1	1	1
CO 5	3	2	1	1								1	2	1	1

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**BASIC STANDARD MEASUREMENTS CONCEPT**	Periods	**9**

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Standards of Measurement & Errors- theory of errors, electrical measuring instruments and their classification. Static and dynamic characteristics – AC Bridge measurements: – Maxwell, Hay, Schering, Anderson and Wien bridge.			
Unit – II	**TRANSDUCERS**		
Classification of transducers-Selecting a transducer- strain gauges - Temperature Transducers - Linear Variable Differential Transformer (LVDT)-RVDT – Capacitive Transducers, – Piezo-electric Transducers - Basic Hall Effect sensors and Optoelectronic Transducers - Smart/intelligent sensors.			
Unit – III	**INSTRUMENTS FOR SIGNAL GENERATION AND ANALYSIS**	Periods	**9**
Introduction- Sine wave generator- frequency synthesized signal generator- Sweep generators - pulse and square wave generator-Wave analyzers-Harmonic distortion analyzer-Spectrum analyzer - Vector Network Analyzer-Block diagram of General Purpose Oscilloscope-Measurement of voltage, current, phase and frequency using CRO - MSO - DSO.			
Unit – IV	**INDICATING AND DISPLAYING INSTRUMENTATION SYSTEMS**	Periods	**9**
D'ARSONAL Galvanometer- PMMC Mechanism- DC Ammeters and voltmeters- Q meters-RF power and voltage measurement-high frequency measurement - frequency meter, True RMS meters – Dual trace and beam oscilloscope-Analog and digital storage oscilloscope.			
Unit – V	**DIGITAL DATA ACQUISITION & INSTRUMENTATION SYSTEMS**	Periods	**9**
Analog and Digital data acquisition system – multiplexing –data loggers – computer controlled instrumentation- Introduction to IEEE 488/GPIB Buses - Virtual instruments. Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Digital Frequency counter- Data Loggers.			
		Total Periods	**45**

Text Books	
1.	Helfrick and Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice-Hall, 2007.
2.	Sawhney A K, A course in Electrical and Electronic Measurement and instrumentation, Dhanpat Rai and Sons,New Delhi, 2000
References	
1.	Joseph J Carr, Elements of Electronic Intrumentation and Measurement, Pearson Eduation, New Delhi, 2008
2.	Nakra B C and Choudhury K.k., Instrumentation Measurement and Analysis, Tata McGraw Hill, New Delhi, 2004.
3.	Jovitha Jerome, Virtual Instrumentation Using LabView, Prentice Hall of India, New Delhi, 2010.
4.	Garry M Johnson, Lab View Graphical Programming, Tata McGraw Hill, New Delhi, 2010.
5.	Ernest o Doebelin and dhanesh N manik, ―Measurement systems, 5th edition, McGraw-Hill, 2007.
E-Resources	
1.	https://gradeup.co/practice/quiz/electrical-engineering/measurements-instrumentation
2.	https://unacademy.com/course/previous-year-gate-questions-on-measurements/WH3EQ5BN
3.	https://www.studynama.com/community/threads/pdf-electrical-electronic-measurements-gate-solved-questions-previous-year-for-electrical-engineering-free-download.3927/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**IV**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC415	**Analog and Linear Integrated Circuits Laboratory**	0	0	2	1	60	40	100

Course Objective

The student should be made to,

- Implement amplifiers using bipolar Junction Transistors.
- Analyze RC and LC oscillators.
- Evaluate the output of amplifier circuits.
- Design and test mathematical operation using OP-Amp.
- Illustrate characteristics and of filter and oscillator.
- Examine the operation of PLL

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Design and construct the amplifiers and oscillators	K6
CO2: Evaluate the output of analog circuits	K5
CO3: Demonstrate the mathematical operation using OP-Amp	K2
CO4: Understand performance of filter and oscillator circuits	K1
CO5: Examine the operation of PLL	K4

Pre-requisites: -

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 – Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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			2			2	2	2			2	2	2
CO 2	3	2			2			2	2	2			2	2	
CO 3	2	2			2			2	2	2			3	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. Pre lab and Post lab Test. 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey.

Content of the syllabus

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List of Experiments		Course Outcome
1.	Series and Shunt feedback amplifiers: Frequency response, input and output impedance calculation	CO1
2.	Design of R-C Oscillators (Phase Shift and Wien Bridge)	CO1
3.	Design of L-C Oscillators (Colpitts and Hartley)	CO2
4.	Design of Class – C tuned Amplifier	CO2
5.	Design of Astable and Bistable multivibrators.	CO3
6.	Inverting and Non inverting amplifiers using Op-Amp.	CO3
7.	Integrator, Differentiator and Instrumentation Amplifier using Op-Amp.	CO4
8.	Active Low pass filters, A/D and D/A convertor using OP-Amp.	CO4
9.	PLL characteristics and its use as Frequency Multiplier.	CO5
10.	Voltage Regulator using IC723.	CO5
	Total Periods	**45**

Text Books	
1.	David A.Bell, "Electronic devices and Circuits", Prentice Hall of India, 2004.
2.	D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 4th Edition, New Age International Pvt. Ltd., 2011.

E-Resources	
1.	https://www.electronics-tutorials.ws/amplifier/
2.	https://www.multisim.com/help
3.	https://www.it.iitb.ac.in/nmeict/videoDownloads.html?workshopid=OFQvSNjTnULIt65H-YPpEA
4.	https://swayam.gov.in/
5.	https://en.wikipedia.org/

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Programme	**B.E.**	Programme code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**IV**

Course code	Course Name	Periods /Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC416	**Digital Signal Processing Laboratory**	0	0	2	1	60	40	100

Course Objective

- To Generate Different signals using MATLAB and DSP Processor.
- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, DFT using MATLAB and DSP Processor.
- To implement FIR and IIR filters in MATLAB and DSP Processor.
- To study the architecture of DSP processor.
- To implement the Multi-rate signal processing in MATLAB and DSP Processor

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Carryout to generate different signals using MATLAB and DSP	K2
	CO2: Analyze the basic operations using MATLAB and DSP Processor.	K2
	CO3: Design and Implement the FIR and IIR Filters using MATLAB and DSP	K2
	CO4: Analyze the architecture of a DSP Processor.	K2
	CO5: Design a Multi-rate system using MATLAB and DSP Processor.	K2

Pre-requisites	Signals and Systems & Digital Signal Processing

COs Vs POs & PSOs
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

SUB.CODE & NAME	**DSP Laboratory**														
COURSE OUTCOME	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	3	3	2	2	2	2					2	2	3		2
CO2	3	3	2	2	2	2					2	2	3		2
CO3	3	3	2	2	2	2					2	2	3		2
CO4	3	2	2	2	2	2					2	2	3		2
CO5	3	2	2	2	2	2					2	2	3		2

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Course Assessment Methods

Direct
1. Pre lab and Post lab Test. 2. Assignment 3. End-Semester examinations
Indirect
1. Course - end survey.

S.No	List of Experiments	Course Outcome
1.	Generation of different types of Signals.	CO1
2.	Computation of DFT of signal input sequence	CO1
3.	Design and Implementation of Linear and Circular Convolution.	CO2
4.	Design and Simulation of FIR (LPF, HPF, BPF& BSF) filters.	CO4
5.	Design and Simulation of IIR (LPF, HPF, BPF& BSF) filters.	CO4
6.	Design and Simulation of sampling and sampling rate conversion.	CO2
	DSP PROCESSOR Experiments:	
7.	Study of architecture of Digital Signal Processor	CO3
8.	Generation of Signals.	CO1
9.	Computation of a DFT of a signal.	CO1
10.	Design and Implementation of Linear and Circular Convolution.	CO2
11.	Design and Implementation of FIR filters.	CO4
12.	Design and Implementation of IIR filters.	CO4
13.	Implement an Up-sampling and Down-sampling operation in DSP Processor	CO5
	Total Periods	**45**

Suggested Lab Manuals:

1. Vinay K.Ingle , John G Proakis, "Digital Signal Processing using MATLAB " ,3rd Edition,CENGAGE Learning
2. Sophocles J. Orfanidis, "DSP Lab Manual", RUTGERS UNIVERSITY, The State University of New Jersey

E-Resources

1.	http://research.iaun.ac.ir/pd/naghsh/pdfs/UploadFile_6417.pdf
2.	https://en.wikipedia.org/wiki/Digital_signal_processor

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	B.E/B.TECH	Programme code	103	Regulation	2019
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	IV

Course code	Course Name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EN401	Communication Skills laboratory	0	0	3	1	100	-	100

Objective	• Equip with effective Soft skills in English. • Enhance them with intrapersonal skills. • Effective management of time and stress.	
Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Able to communicate, present, describe and discuss fluently in English.	K1
	CO2: Equipped for an easy transition from studying to working atmosphere.	K1
	CO3: Accomplished with planning and corporate Managerial skills.	K2
	CO4: To attain professional correspondence and execute the same in professional manner.	K4
	CO5: To employ the professional needs and accomplishments at global standards.	K4
Pre-requisites	Nil	

CO / PO Mapping
(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
CO 1	-	-	-	-	-	2	-	-	3	3	-	3	-	2
CO 2	-	-	-	-	-	2	-	-	2	3	-	3	-	2
CO 3	-	-	-	-	-	2	-	-	2	2	-	3	-	1
CO 4	-	-	-	-	-	2	-	-	3	3	-	3	-	2
CO 5	-	-	-	-	-	2	-	-	3	3	-	3	-	3

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English Language Proficiency: Listening Comprehension, Reading Comprehension, Common Errors in English, Diction and its usage, Framing sentences – Idiomatic Expressions.		
Resume – Structuring and Drafting the resume – Cover letter- Writing Professional Letters		
Group Discussion: Introduction – Topic Analysis – Thematic Expressions-Objective and content of discussion – Persuasion – Discussion – Controlling Emotions - Presentation of the group – Offering support – Use of functional Language - Summary and conclusion		
Presentation skills: Making Self Introduction effectively-Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Accents analysis – Stylistics.		
Soft Skills: Introduction - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft skills - Ability to work as a team - Innovation, Creativity and Lateral thinking – Flexibility - Personality Traits and Soft Skills for future Career Advancement-Personality and Soft Skills for career growth- Time management.		
	Total Periods	45

Lab Manuals suggested:	
1.	Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2.	John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
UI9EC518	**Control Systems**	3	0	0	3	40	60	100

Course Objective

The student should be made to

- Define the open loop and closed loop (feedback) systems and show the transfer function of the system
- Determine time response and frequency response of the system
- Analyze the stability of a control system
- Design the Various compensation technique to stabilize control systems
- Develop various state space models and test controllability and observability of the system

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Compute the transfer function of different physical systems	K3
	CO2: Analyze time domain specifications and calculate the steady state error	K4
	CO3: Illustrate the frequency response characteristics of open and closed loop system	K3
	CO4: Analyze the stability using Routh and root locus techniques	K4
	CO5: Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.	K3
Pre-requisites		

CO / PO Mapping (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	2									3	2	
CO 2	3	2	2	2									3	2	2
CO 3	3	2	2	2									3	2	
CO 4	3	3	2	3									3	2	2
CO 5	3	3	2	2									3	2	

Course Assessment Methods

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

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1. Course - end survey

Content of the syllabus

Unit – I	**MODELING OF PHYSICAL SYSTEMS**	Periods	**9**
Elements of Control System – Open loop and closed loop systems - Differential equation - Transfer function, Modeling of Electric systems - Block diagram reduction Techniques - Signal flow graph. State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations.			
Unit – II	**TIME RESPONSE ANALYSIS**	Periods	**9**
Time Domain Specifications- Standard Test Signals- Impulse response - Time Response of First order Systems for unit step and unit ramp input - Time Response of Second order Systems for unit step – Steady State errors and static error constants-error coefficients.			
Unit – III	**FREQUENCY RESPONSE ANALYSIS**	Periods	**9**
Frequency Response Specifications of second order system - Correlation between Time and Frequency Response –Frequency response plot: Polar plot – Bode plot – M and N Circles.			
Unit – IV	**STABILITY ANALYSIS AND LINEAR SYSTEM DESIGN**	Periods	**9**
The Concepts of Stability - Necessary Conditions for Stability - Routh Hurwitz Criterion –Nyquist Stability Criterion - Root Locus Construction. Introduction- Compensators and Controllers-Design of Feedback Compensation Scheme using Bode plot.			
Unit – V	**STATE VARIABLE ANALYSIS AND DIGITAL CONTROL SYSTEM**	Periods	**9**
Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sample & Hold – Open loop & Closed loop sampled data systems.			
		Total Periods	**45**

Text Books

1.	J.Nagrath & M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2017.
2.	Benjamin.C.Kuo, "Automatic Control System", Prentice Hall of India, 8th Edition, 2003.
3.	A. Nagoor Kani, "Control Systems " REA Publications, 3rd Edition, 2017

References

1.	Richard C. Dorf & Robert H. Bishop, "Modern Control System", Prentice Hall, 2010.
2.	M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
3.	K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
4.	S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
5.	Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.

E-Resources

1.	https://www.cgaspirants.com/2018/01/download-control-system-engineering-by-i-j-nagrath-book-pdf.html
2.	http://gppuri.in/pdf/lecturenotes/Control%20system%20note%20for%206th%20sem%20electrical.pdf
3.	https://www.sanfoundry.com/1000-control-systems-questions-answers/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC519	**Microprocessor and Microcontroller**	3	0	0	3	40	60	100

Course Objective	The student should be made to • Study the Architecture of 8085 and 8086 microprocessor. • Learn the design aspects of I/O and Memory Interfacing circuits. • Study the addressing modes and instruction set of 8086 and 8051 • Study the Architecture of 8051 microcontroller. • Develop skill in simple program writing for 8086 and 8051 applications	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Interpret and execute programs based on 8085 and 8086 microprocessor	K2
	CO2: Interpret 8086 signals and bus operations	K2
	CO3: Design and interface I/O circuits	K3
	CO4: Design and implement 8051 microcontroller based systems	K3
	CO5: Summarize applications using microprocessor / microcontroller	K2
Pre-requisites	**-**	

CO / PO Mapping (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	2							2		3	2	2
CO 2	3	3	2	2							2		3	2	
CO 3	3	2	2	2				2			2		2	2	
CO 4	3	2	2	2							2		2		2
CO 5	3	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

Content of the syllabus

Unit – I	**8- BIT and 16 - BIT MICROPROCESSOR.**	Periods	**9**

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8085 Architecture, Instruction set, Addressing modes, Interrupts, Timing diagrams, Memory and I/O interfacing. 8086 Architecture, Instruction set and programming, Minimum and Maximum mode configurations.			
Unit – II	**8086 SYSTEM BUS STRUCTURE**	Periods	**9**
8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.			
Unit – III	**I/O INTERFACING**	Periods	**9**
Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface– D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.			
Unit – IV	**MICROCONTROLLER**	Periods	**9**
Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.			
Unit – V	**INTERFACING MICROCONTROLLER**	Periods	**9**
Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.			
		Total Periods	**45**

Text Books	
1.	Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.
2.	A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012
References	
1.	Yu-Cheng Liu, Glenn A. Gibson, “Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design”, 2nd Edition, Prentice Hall of India, 2014.
2.	Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, 2nd Edition, Pearson Education, 2011.
3.	Krishna Kant, “Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096’’, PHI, 2007, 7th Reprint, 2015.
4.	Kenneth J. Ayala., “The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning’’, 2012.
5.	A.K. Ray, K.M. Bhurchandi, “Advanced Microprocessor and Peripherals’’, Tata McGraw-Hill, 2nd Edition, 2010.
E-Resources	
1.	https://www.worldcat.org/title/microprocessors-and-interfacing-programming-and-hardware/oclc/611374608
2.	https://pdfcoffee.com/ak-ray-and-km-bhurchandi-advanced-microprocessors-and-peripherals-3e-tata-mcgraw-hill-2012pdf-pdf-free.html
3.	https://pdfcoffee.com/1pdfnetmicrocomputer-systems-the-8086-8088-family-architecture-pdf-pdf-free.html
4.	https://www.sanfoundry.com/microcontroller-mcqs-introduction/

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Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**V**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC520	**Transmission Lines and Waveguides**	3	0	0	3	40	60	100

Course Objective	The main objectives of this course is • Introduce the concept of signal propagation through transmission lines. • Describe signal propagation at Radio frequencies and uses of Smith chart. • Illustrate the waveguide Structures and propagation modes • Explain & analyze and design of circular waveguides and resonators • Learn the basics of Planar transmission lines.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Summarize and understanding of the fundamental transmission line concepts.	K2
	CO2: Design simple matching networks using lumped elements, quarter - wave sections, and the Smith chart & its use for fundamental transmission line calculations.	K3
	CO3: Analyze the electromagnetic fields configuration within the guides and general wave behaviors along uniform guiding structures.	K3
	CO4: Design the basic principles associated with waveguides (metallic and dielectric): Mode (TM, TE, TEM), cutoff frequency, guided wavelength, velocities.	K3
	CO5: Describe the various types of planar transmission liines.	K4
Pre-requisites	Network theory,Electromagnetic fields	

CO / PO Mapping (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	3	3						2		2	3	2	2
CO 2	3	3	3	3									2	2	2
CO 3	3	3	2	3						2		2	3		
CO 4	3	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

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Content of the syllabus

Unit – I	**TRANSMISSION LINE THEORY**	Periods	**9**

A line of cascaded T Sections -Transmission lines - General Solution -Physical significance of the equations - infinite line – wavelength, velocity of propagation , Distortion less line, the telephone cable – Reflection on a line not terminated in Zo, Reflection coefficient – Open and short circuited lines – insertion loss.

Unit – II	**THE LINE AT RADIO FREQUENCIES**	Periods	**9**

Parameters of the open wire at RF frequencies – Voltage and currents on the dissipation less line - Standing waves, nodes, standing wave ratio –input impedance of the dissipation less line – input impedance of open and short circuited lines – Power and impedance measurement on lines – The eighth wave line, quarter wave line, half wave line –The Smith chart and its applications – single stub and double matching with the Smith chart-Problem solving using Smith chart.

Unit – III	**GUIDED WAVES AND RECTANGULAR WAVEGUIDES**	Periods	**9**

Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – characteristics of TE and TM Waves – Transverse Electromagnetic waves – Manner of wave travel - Velocities of the waves – Application of Maxwell's equations to the rectangular wave guide -Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves - Impossibility of TEM waves in waveguides

Unit – IV	**CIRCULAR WAVE GUIDES AND RESONATORS**	Periods	**9**

Cylindrical wave guides –Bessel function-TE and TM waves in circular wave guides– Excitation of wave guides – guide terminations – Resonant cavities-Rectangular cavity resonator-Field expressions - cutoff frequency-Quality factor.

Unit – V	**PLANAR TRANSMISSION LINES**	Periods	**9**

Introduction to Planar transmission lines-Types- Strip line, Microstrip Line, Coplanar Waveguide Coplanar Strip Line and Slot Line.-Geometrical structure ,Field configurations ,Attenuation and Design equations (qualitative treatment only)

Total Periods	**45**

Text Books

1.	J. D. Ryder, "Networks, Lines and Fields", PHI, New Delhi, 2003.
2.	E.C. Jordan and K.G. Balmain "Electro Magnetic Waves and Radiating System", PHI, New Delhi, 2003.
3.	Anand K. Verma ,Introduction To Modern Planar Transmission Lines: Physical, Analytical, and Circuit Models Approach, Wiley – IEEE press , 2021

References

1.	Mathew N.O.Sadiku — "Elements of Electro Magnetics", 2nd Edition, Oxford, New York, 2005.
2.	Ramo,Whineery and Van Duzer, "Fields and Waves in Communication Electronics" John Wiley, 2003
3.	Stephen H. Hall, Howard L. Heck, "Advanced Signal Integrity For High-Speed Digital Designs", John Wiley & Sons, 2009
4.	Reinmut K Hoffman, "Handbook of Microwave Integrated Circuits", Artech House, 1987.
5.	R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill Publications, 2006

E-Resources

1.	http://tubebooks.org/Books/martin_1955_electronic-circuits.pdf
2.	https://www.coursehero.com/file/p1iskj2b/2-Electromagnetic-Waves-and-Radiating-Systems-EC-Jordan-and-KG-Balmain-PHI-2nd/
3.	https://easyengineering.net/elements-of-electromagnetics-sadiku/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**V**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC521	**Analog and Digital Communication**	3	1	0	4	40	60	100

Course Objective	The student should be made to • Fundamental understanding on Communication Systems with emphasis on analog modulation techniques and noise performance • Introduce random processes and their characteristics • Get acquainted with the process of sampling, quantization and coding. • Learn baseband pulse transmission, Nyquist criterion and solutions. • Understand baseband and band pass signal transmission and reception techniques.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: comprehend and appreciate the significance and role of this course in the present contemporary world	K3
	CO2: Evaluate the influence of noise on communications signals.	K6
	CO3: Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.	K4
	CO4: Apply line coding and pulse shaping techniques for data transmission.	K4
	CO5: Design and implement band pass signaling schemes.	K3
Pre-requisites	-	

CO / PO Mapping (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							2			3		2
CO 2	3	2	2										3		2
CO 3	3	2	3							2			3		
CO 4	3	2									2			3	
CO 5	3	2												3	

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment **3.** End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

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Unit – I	**AMPLITUDE AND ANGLE MODULATION SYSTEMS**	Periods	**9**
Generation and demodulations of AM, DSBSC, SSB and VSB signals-voltage, current and power relationship- frequency spectrum for sinusoidal AM -AM transmitter and receiver. Generation and Demodulation of FM –FM transmitter. Frequency and Phase Modulation-Equivalence between FM and PM.			
Unit – II	**NOISE THEORY**	Periods	**9**
Gaussian Random Process-Stationary Random Process- Noise – Shot noise, Partition noise, Burst noise, Thermal noise and white noise; Narrow band noise, Noise factor, Noise temperature; Noise Figure.			
Unit – III	**DIGITAL COMMUNICATION**	Periods	**9**
Digital Communication: Functional Description- Channel Classification - Low pass sampling-Aliasing-Signal Reconstruction-Quantization-Uniform and Non Uniform Quantization-Quantization Noise-Logarithmic Companding of Speech signal-PCM-TDM			
Unit – IV	**BASEBAND TRANSMISSION TECHNIQUES**	Periods	**9**
Properties of Line codes-Power spectral density of Unipolar/Polar RZ,NRZ-Bipolar NRZ,Manchester ISI, Nyquist criterion for distortion less transmission-Pulse Shaping-Correlative coding-Mary Schemes-Eye pattern-Equalization.			
Unit – V	**BAND PASS MODULATION TECHNIQUES**	Periods	**9**
Amplitude Shift Keying, Binary Phase Shift Keying- Quadrature Amplitude Modulation- Binary Frequency Shift Keying-Quadrature Phase Shift Keying-Carrier synchronization, Structure of Non coherent receivers-Principle of DPSK.			
		Total Periods	**45**

Text Books

1.	B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd Edition, Oxford Press, 2011.
2.	Simon Haykins, “Digital Communications”, John Wiley, 2013

References

1.	Simon Haykin, “Communication Systems”, John Wiley & Sons, Newark, 4th Edition, 2001.
2.	Dennis Roddy & John Coolen – “Electronic Communication”4th Edition, Prentice Hall of India.
3.	John.G.Proakis, “Digital Communication”, 4th Edition, Pearson Education, 2006.
4.	Amitabha Bhattacharya, “Digital Communications”, Tata McGraw Hill, 2006
5.	Sam K.Shanmugam ―Digital & Analog Communication systems‖ John Wiley,2008.

E-Resources

1.	https://edisciplinas.usp.br/pluginfile.php/5251120/mod_resource/content/1/B.%20P.%20Lathi%2C%20Zhi%20Ding%20%20Modern%20Digital%20and%20Analog%20Communication%20Systems-Oxford%20University%20Press%20%282009%29.pdf
2.	https://books.google.co.in/books/about/Digital_Communication_Systems.html?id=YGZXAAAACAAJ&redir_esc=y
3.	http://web.stanford.edu/class/ee359/doc/WirelessComm_Chp1-6_Dec182019.pdf

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Programme	**B.E**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC522	**Microprocessor and Microcontroller Laboratory**	0	0	2	1	60	40	100

Course Objective

The student should be made to,

- Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051.
- Differentiate the Serial and Parallel Interface.
- Interface different I/Os with Microprocessors.
- Determine the operation of Microprocessors, Arduino and PIC.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Illustrate the ALP concepts and features.	K2
	CO2: Develop various arithmetic and logical operations in 8086 and 8051.	K3
	CO3: Analyze the Serial and Parallel Interface.	K4
	CO4: Distinguish the interface between different I/Os with Microprocessors, Arduino and PIC.	K3
	CO5: Evaluate the data transfer information through serial & parallel ports with Microprocessors, Arduino and PIC.	K6

Pre-requisites -

CO / PO Mapping
(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		**2**			2			3	2	
CO 2	3	2	**2**		2	**2**					**2**		2		**2**
CO 3	3	2	2		2	2					2		2	2	
CO 4	3				2	2				2	2		2		
CO 5	3	2			2					2					2

Course Assessment Methods

Direct
1. Pre lab and Post lab Test. 2. Assignment **3.** End-Semester examinations
Indirect
1. Course - end survey.

Content of the syllabus

	Course Outcome
8086 Programs using kits and MASM	CO1,CO2

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1.	Programs for 16 bit Arithmetic operations.	CO1
2.	Programs for Sorting and Searching using MASM	CO3
3.	Interfacing ADC and DAC.	CO3
4.	Parallel Communication between two MP Kits using Mode 1 and Mode 2 of 8255.	CO4
5.	Interfacing and Programming 8279, 8259, and 8253.	CO3
6.	Serial Communication between two MP Kits using 8251**.**	CO4
7.	Interfacing and Programming of Stepper Motor and DC Motor Speed control.	CO1
8051 Experiments using kits		
1.	Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.	CO1,CO2
2.	Communication between 8051 Microcontroller kit and PC.	CO5
Arduino		
1.	Interfacing switch and LED with Arduino.	CO5
PIC		
1.	Interrupt programming using PIC.	CO5
2.	USART programming using PIC.	CO5
Miniproject		
	Total Periods	**45**

Text Books	
1.	Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", 2nd Edition, Prentice Hall of India, 2014.
2.	Muhammed Ali Mazidi, Rolind D Mckinlay, Danny Causey "PIC Microcontroller and Embedded Systems", Pearson Edition 2008.
3.	Michael-Margolis,Arduino-Cookbook., Revised edition, O'Reilly,1st edition, 2011.
4.	D.Dale.Wheat, Arduino.Internals, TIA publication, 5th edition, 2011.
E-Resources	
1.	https://pdfcoffee.com/1pdfnetmicrocomputer-systems-the-8086-8088-family-architecture-pdf-pdf-free.html
2.	http://www.staroceans.org/kernel-and-driver/PIC%20Microcontroller%20and%20Embedded%20Systems%20Using%20ASM%20%26%20C%20for%20PIC18.pdf
3.	https://www.worldcat.org/title/pic-microcontroller-and-embedded-systems-using-assembly-and-c-for-pic18/oclc/77476437

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Programme	**B.E**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC523	**Analog and Digital Communication Laboratory**	0	0	2	1	60	40	100

Course Objective

The student should be made to,

- introduce the relevance of this course to the existing technology through demonstrations, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- Analyze the various types of modulation and demodulation techniques.
- Demonstrate the sampling theorem, amplitude modulation (AM), binary modulation and power measurements.
- Analyze the various types of Line Coding techniques

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Demonstrate analog modulation techniques	K4
	CO2: Interpret various pulse modulation techniques	K2
	CO3: Construct various receiver circuits	K4
	CO4: Apply line coding techniques for data transmission	K3
	CO5: Analyze various digital modulation schemes.	K4

Pre-requisites -

CO / PO Mapping
(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			2					2			3		
CO 2	3	2			2	**2**				2			3	3	**2**
CO 3	3	2			2	2				2	2		3		
CO 4	3		2		3	2							3	3	2
CO 5	3		2		3						2		3		

Course Assessment Methods

Direct
1. Pre lab and Post lab Test. 2. Assignment **3.** End-Semester examinations
Indirect
4. Course - end survey.

Content of the syllabus

List of Experiments	**Course Outcome**

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1.	Design and construction of transistor based Amplitude modulator and Demodulator.	CO1
2.	Design of Frequency Modulator and Demodulator	CO1
3.	Generation and detection of Pulse Modulation – PAM / PWM / PPM.	CO2
4.	Analyze of a PCM system and interpret the modulated and demodulated waveforms.	CO2
5.	Analyze of a Delta Modulator and Adaptive Delta Modulator.	CO4
6.	Design and implementation of Digital Modulation & Demodulation (ASK, PSK, FSK) and its simulation using MATLAB.	CO5
7.	Designing, Assembling and Testing of Pre-Emphasis & De-emphasis Circuits.	CO3
8.	Designing, Assembling and Testing of Phase locked loop.	CO3
9.	Sampling & Time Division Multiplexing using PAM signals.	CO2
10.	Performance of different Line Coding (NRZ, RZ & Manchester).	CO4
11.	Mini Project.	CO5
	Total Periods	**45**

Text Books

1.	B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford Press, 2011.
2.	Sam K.Shanmugam ―Digital & Analog Communication systems‖ John Wiley,2008.

E-Resources

1.	https://edisciplinas.usp.br/pluginfile.php/5251120/mod_resource/content/1/B.%20P.%20Lathi%2C%20Zhi%20Ding%20-%20Modern%20Digital%20and%20Analog%20Communication%20Systems-Oxford%20University%20Press%20%282009%29.pdf
2.	https://content.kopykitab.com/ebooks/2013/09/1871/sample/sample_1871.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VI**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC625	**VLSI Design**	3	0	0	3	40	60	100

Course Objective	The student should be made to • Learn the concepts of VLSI design flow and basic CMOS circuits. • Analyze the characteristics of CMOS transistor. • Evaluate the characteristics of CMOS power, clock systems and CMOS data path design. • Understand the concept of testing and various testing techniques. • Learn the concepts of modeling a digital system using Hardware Description Language.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Analyze the VLSI design flow and learn about basic CMOS circuits.	K4
	CO2: Analyze the characteristics of CMOS transistor.	K4
	CO3: Design combinational and sequential circuits with low power.	K3
	CO4: Know about need for testing and to compare the concept various testing techniques.	K2
	CO5: Synthesize the combinational and sequential circuits using Verilog HDL.	K5
Pre-requisites	**Digital System Design**	

CO / PO Mapping (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	2	2					2				3		
CO 2	3	2								2	2		3	2	2
CO 3	3	2	2	2									3	2	
CO 4	3	2							2	2			2		2
CO 5	3	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

Content of the syllabus

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Unit – I	MOS TRANSISTOR AND CMOS PROCESS TECHNOLOGY	Periods	9
Integrated Circuit Design Techniques, VLSI Design Flow -MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal I-V effects, DC transfer characteristics. Switch level RC delay models. CMOS Fabrication methods-P-well, N-well, Twin Tub, SOI. CMOS process enhancements, Layout design Rules, CMOS Logic. Technology related CAD issues, manufacturing issues.			
Unit – II	**CIRCUIT AND DEVICE CHARACTERIZATION**	Periods	**9**
Delay estimation, Logical effort and Transistor sizing, Power dissipation, Interconnect, Design margin, Reliability, Scaling- SPICE tutorial, Device models, Device characterization, Circuit characterization.			
Unit – III	**COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN**	Periods	**9**
Circuit families –Low power logic design – comparison of circuit families – Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology- sequencing dynamic circuits – synchronizers, Data Path Subsystem Design-Addition/Subtraction ,Comparators.			
Unit – IV	**CMOS TESTING**	Periods	**9**
Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – FPGA Building Block Architectures, FPGA Interconnect Routing Procedures Design for testability- Ad hoc Design, Scan Design, IDDQ Testing ,Built in Self Test (BIST) –Boundary scan			
Unit – V	**VERILOG HDL**	Periods	**9**
Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modeling, Design hierarchies, Behavioral and RTL modeling, Test benches, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.			
		Total Periods	**45**

Text Books

1.	Neil Weste & David Harris , "CMOS VLSI Design-A circuits & System Perspective", 4th Edition, Pearson education, New Delhi, 2017
2.	Palnitkar Samir, "Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education , New Delhi, 2017.

References

1.	R. Jacob Baker, Harry W. Li, David E. Boyce, "CMOS Circuit Design, Layout and Simulation" ,IEEE Press Series on Microelectronics Systems Stuart K. Tewksbuy, Series Edition,2011.
2.	Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design" Prentice Hall,Third Edition.
3.	Samir Palnitkar, "Verilog HDL A Guide to Degital Design and Synthesis", second Edition.
4.	Wayne Wolf, "Modern VLSI Design: System On Chip", Pearson Education, 2007
5.	Sung-Mo kang, Yusuf leblebici, Chulwoo Kim "CMOS Digital Integrated Circuits:Analysis & Design",4th edition McGraw Hill Education,2013

E-Resources

1.	https://www.cin.ufpe.br/~mel/pub/prototipac%E3o/referencias/CMOS_design/CMOS-VLSI-design.pdf
2.	http://www.icisclab.com/userfiles/file/download/Verilog%20HDL%20Synthesis%20A%20Practical%20Primer.pdf
3.	https://www.ucursos.cl/usuario/9553d43f5ccbf1cca06cc02562b4005e/mi_blog/r/CMOS_Circuit_Design__Layout__and_Simulation__3rd_Edition.pdf
4.	https://www.abebooks.com/book-search/title/basic-vlsi-design/author/douglas-pucknell-kamran-eshraghian/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VI**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC626	**Computer Networks**	3	0	0	3	40	60	100

Course Objective	The student should be made to • Understand the state-of-the-art in network protocols, architectures and applications. • Familiarize the various aspects of computer networks • realize the different layers of ISO /OSI model and TCP/IP Network IEEE standards. • Be aware of IP addressing methods and QOS parameters. • Know the functions and congestion control mechanism of TCP.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Interpret the basic functions of networks, ISO/OSI model and several Switching method	K2
	CO2: Illustrate the error detection and control mechanisms involved in the data link layer of different IEEE standards	K2
	CO3: Apply Packet switching, sub netting and routing according to the functions of network layer	K3
	CO4: Apply Techniques for control the congestion in the network	K3
	CO5: Analyze Various Network Applications Like Ftp, Email, Http With Network Security	K4
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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							2			3		
CO 2	3	3	2	2									3	2	2
CO 3	3	3	2	2						2		2	3		
CO 4	3	2	2	2									3	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

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Indirect
1. Course - end survey

Content of the syllabus

Unit – I	INTRODUCTION	Periods	9

Internet- Service description - Network Edge - Network Core - Circuit Switching and Packet Switching - Packet Switched Networks - Datagram and Virtual Circuit - Access Networks and Physical Media -ISP's and Internet Backbones – Delay and Loss in Packet Switched Networks – Protocol Layers and Service Models

Unit – II	DATA LINK LAYER	Periods	9

Link Layer Services – Error Correction and Detection Techniques – Multiple Access Protocols – Link Layer Addressing – Ethernet-Hubs and Switches – Point-to-Point Protocol – Link Virtualization – ATM – MPLS, Flow control-Ethernet Protocols-Stop & wait -Go-Back- N Selective repeat-High-Level Data Link Control

Unit – III	NETWORK LAYER	Periods	9

Routing Algorithms – LinkState Routing – Distance Vector Routing – Routing in Internet – RIP – OSPF – BGP. Virtual Circuit and Datagram Networks-Internet Protocol (IP)-IPV4-IPV6- Broadcast and Multicast Routing- Mobile IP

Unit – IV	TRANSPORT LAYER	Periods	9

Transport Layer Services – Multiplexing and De-multiplexing – User Datagram Protocol (UDP) – Principles of Reliable Data Transfer – Transmission Control Protocol (TCP). Transport Layer services-Elements of transport Protocols-A simple transport Protocol - Performance issues- Quality of service-techniques to improve QoS

Unit – V	PRESENTATION AND APPLICATION LAYER	Periods	9

Protocol Layers and Service Models – Principles of Network Applications – Web and HTTP – File Transfer Protocol – Electronic Mail – SMTP – Domain Name System – P2P File Sharing – Socket Programming with TCP, Introduction to Cryptography–basic concepts-firewalls.

Total Periods	**45**

Text Books

1.	James F.Kurose & Keith W.Ross, "Computer Networking A Top-down Approach Featuring the Internet", PHI, 2013.
2.	Andrew S.Tannenbaum, Computer Networks, PHI, 2003

References

1.	Behrouz Foruzan, Data communication and Networking, Tata McGraw-Hill, 2012.
2.	Larry L.Peterson & S.Peter Davie, "Computer Networks", Harcourt, 2004.
3.	William Stallings, "Data and Computer Communication", PHI 2006.
4.	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, ―Computer Networks: An Open Source Approach‖, Mc Graw Hill Publisher, 2011.
5.	Larry L. Peterson, Bruce S. Davie, ―Computer Networks: A Systems Approach‖, Fifth Edition, Morgan Kaufmann Publishers, 2011.

E-Resources

1.	https://abdulkadirsyam.files.wordpress.com/2010/02/computer-networking-a-top-down-approach-featuring-the-internet.pdf
2.	https://theswissbay.ch/pdf/Gentoomen%20Library/Networking/Prentice%20Hall%20-%20Computer%20Networks%20Tanenbaum%204ed.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VI**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC627	**Antenna and Wave Propagation**	3	0	0	3	40	60	100

Course Objective	The student should be made to • Impart knowledge on basics of antenna theory. • Learning the antenna arrays and aperture antennas • Give a thorough appreciative of the radiation characteristics of different types of antennas • Learn Modern and special antennas such as frequency independent and broad band antennas. • Identify with various techniques involved in various antenna parameter measurements.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Study the depth understanding of basic antenna parameters	K2
	CO2: Understand depth study for the analysis and design of wire antennas and antenna arrays	K2
	CO3: Analyze Modern and special antennas such as frequency independent and Antenna measurement	K4
	CO4: Study the depth about aperture and lens antennas.	K2
	CO5: Expose the effect of propagation of radio waves in actual environment	K3
Pre-requisites		

CO / PO Mapping (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							2			3		2
CO 2	3	3	2	2							2			3	
CO 3	3	3	2							2		2	3		
CO 4	3	3	2								2		3	3	2
CO 5	3	2	2	2						2			3		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

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Unit – I	ANTENNA FUNDAMENTALS	Periods	9
Introduction to antenna Parameters- Radiation Pattern, Radiation intensity, Beam solid angle, Gain, Directive gain, Power gain, Directivity, Beam Width. Band Width, Reciprocity principle, Effective length, Effective area, Relation between gain, effective length and radiation resistance, Friis Transmission formula, Antenna Field Zones, Polarization, Self and mutual impedances of antennas.			
Unit – II	**WIRE ANTENNAS AND ANTENNA ARRAYS**	Periods	**9**
Concept of vector potential- Retarded vector potential- Fields associated with Hertzian dipole. Power radiated and radiation resistance of Hertzian dipole. Radiation from half-wave dipole and quarter-wave monopole, Radiation resistance of half wave dipole and quarter wave monopole- Impedance of Folded dipole. Antenna Arrays: Broadside and End fire array -Expression for electric field from two and four element arrays – N element linear array - Pattern multiplication- Binomial array.			
Unit – III	**MODERN ANTENNAS AND ANTENNA MEASUREMENT**	Periods	**9**
Smart antennas- UWB antennas, RFID Antennas, Special Antennas: Loop antennas, Helical antennas, Yagi-uda antenna, Long wire antenna, V antenna, Rhombic antenna, Log periodic antenna, Microstrip antenna. Antenna Measurements: Spectrum Analyzer, Network analyzer, Radiation Pattern Measurement, Gain and Directivity Measurements			
Unit – IV	**APERTURE AND LENS ANTENNAS**	Periods	**9**
Radiation from an elemental area of a plane wave (Huygen's Source), Radiation from a rectangular aperture treated as an array of Huygen's sources, Babinet's principle, Slot antenna- Relation between dipole and slot impedances, Horn antenna – Types, Parabolic reflector antenna and its feed systems, Dielectric lens and metal plane lens antennas,			
Unit – V	**RADIO WAVE PROPAGATION**	Periods	**9**
Modes of propagation, Structure of atmosphere- Ground wave propagation - Space wave propagation- - Duct propagation. Sky wave propagation-Troposcatter propagation-Mechanism of refraction. - Refractive index- Critical frequency. Skip distance - Maximum usable frequency. Fading, Multi hop propagation.			
		Total Periods	**45**

Text Books	
1.	John D.Kraus and Ronalatory Marhefka, "Antennas for all Applications", Tata McGraw Hill, Third Edition, 2010.
2.	Constantine. A Ballanis, "Antenna Theory: Analysis and Design", John Wiley & Sons, 2nd Edition, 2016.
References	
1.	K.D. Prasad, "Antenna and Wave Propagation" Sathyaprakasan Tech India Publications- New Delhi- 2011.
2.	Robert. E. Collin, "Antennas and Radio Propagation", McGraw-Hill, 2004.
3.	A.R. Harish, M. Sachidanada, "Antennas and Wave propagation", Oxford University Press, 2011.
4.	S. Drabowitch, "Modern Antennas", Springer Publications, 2nd Edition, 2007.
5.	H.Sizun, "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint, Springer Publications, 2007
E-Resources	
1.	https://www.researchgate.net/profile/Sajeed_Mulla/post/If_the_EW/attachment/59d6465c79197b80779a1611/AS%3A457537502879744%401486096849945/download/John.+D.+Kraus%2C+Ronald+J.+Marhefka-Antennas-for-All-Applications.pdf
2.	http://www.elcomhu.com/Electrical/Antennas%20/Antenna%20Theory%20Analysis%20and%20Design%20Cropped%20fixed%20Constantine%20A%20Balanis%202nd%20Ed%20John%20Will.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VI**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC628	**Computer Networks Laboratory**	0	0	2	1	60	40	100

Course Objective

The student should be made to,

- Communicate between two desktop computers.
- Larne the Program using sockets
- Develop the various routing algorithms
- Formulate various socket programming.
- Develop and implement the different protocols

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Demonstrate the Communication between two desktop computers	K3
	CO2: Illustrate the Program using sockets	K2
	CO3: Interpret and compare the various routing algorithms	K2
	CO4: Apply congestion control algorithms to Detect and correct the errors in the communication link	K3
	CO5: Analyze performance of various communication protocols.	K4

Pre-requisites -

CO / PO Mapping (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			3		2
CO 2	3		2		3	2		2					3	2	
CO 3	3		2		3	2							3		
CO 4	3		2		2			2		2			3	3	2
CO 5	3		2		2	2							3		2

Course Assessment Methods

Direct
1. Pre lab and Post lab Test. 2. Assignment **3.** End-Semester examinations
Indirect
1. Course - end survey.

Content of the syllabus

List of Experiments	**Course Outcome**

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1.	Implementation of Error Detection / Error Correction Techniques	CO4
2.	Implementation of Stop and Wait Protocol and sliding window	CO5
3.	Implementation and study of Go back-N and selective repeat protocols	CO5
4.	Implementation of High Level Data Link Control	CO3
5.	Write a socket Program for Client – Server model and Echo/Ping/Talk commands	C02
6.	To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.	CO4
7.	Network Topology - Star, Bus, Ring	CO1
8.	Implementation of distance vector routing algorithm and Link state routing algorithm	CO3
9.	Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS	CO4
10.	Encryption and decryption.	CO1
11.	Mini project	CO5
	Total Periods	**45**

Text Books	
1.	James F.Kurose & Keith W.Ross, "Computer Networking A Top-down Approach Featuring the Internet", PHI, 2013.
2.	Andrew S.Tannenbaum, Computer Networks, PHI, 2003

E-Resources	
1.	https://abdulkadirsyam.files.wordpress.com/2010/02/computer-networking-a-top-down-approach-featuring-the-internet.pdf
2.	https://theswissbay.ch/pdf/Gentoomen%20Library/Networking/Prentice%20Hall%20-%20Computer%20Networks%20Tanenbaum%204ed.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VI**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC629	**VLSI Laboratory**	0	0	2	1	60	40	100

Course Objective	The student should be made to, • Introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues • Learn the Hardware Description Language (Verilog/VHDL) • Learn the fundamental principles of VLSI circuit design in digital and analog domain • Familiarize fusing of logical modules on FPGAs • Provide hands on design experience with hardware/software based embedded system.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Implement digital circuits in FPGA using HDL	K2
	CO2: Realize digital circuits satisfying timing and area constraints	K2
	CO3: Synthesize, Place and Route the digital Ips	K5
	CO4: Design, simulate and extract the layout of Analog IC Blocks using EDA tools	K3
	CO5: Comprehend and appreciate the significance and role of this course in the present contemporary world	K4

Pre-requisites	**Digital System Design**

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 – Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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					3			3		2
CO 2	3	3			2	**3**								2	
CO 3	3		3		2					2			3		
CO 4	3	3			3	3								2	2
CO 5	3				3					2			3		

Course Assessment Methods

Direct
1. Pre lab and Post lab Test. 2. Assignment **3.** End-Semester examinations
Indirect
1. Course - end survey.

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Content of the syllabus		
List of Experiments		
Xilinx experiments:		**Course Outcome**
1.	Design and simulation of Full adder, full subtractor and 8 bit adder.	CO1
2.	Design and simulation of Multiplexer, Decoder and 4 bit comparator.	CO2
3.	Verilog HDL based design entry and simulation of Ripple counter, Synchronous counter and BCD counter.	CO1
4.	Design and simulation of simple state machines.	CO4
5.	Design and simulation of 4 bit multiplier using Verilog HDL	CO4
6.	Synthesis, Place & Route and post Place & Route simulation of the components simulated in (1-5) above.	CO3,CO4
FPGA Based Experiments:		
7.	Hardware fusing and testing of each of the blocks simulated in (1-5). Use of either Chip scope feature (Xilinx) or the signal tap feature (Altera) is a must.	CO1
IC Design Experiments (Based on Cadence/MAGMA/Tanner)		
8.	Design and simulation of a simple CMOS Inverter & perform Layout generation, parasitic extraction.	CO4
9.	Layout generation, parasitic extraction and re- simulation of the differential amplifier.	CO4
10.	Mini Project	CO5
	Total Periods	**45**
Text Books		
1.	Palnitkar Samir, "Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education, New Delhi, 2017.	
2.	Neil Weste & David Harris , "CMOS VLSI Design-A circuits & System Perspective", 4th Edition, Pearson education, New Delhi, 2017	
E-Resources		
1.	https://www.cin.ufpe.br/~mel/pub/prototipac%E3o/referencias/CMOS_design/CMOS-VLSI-design.pdf	
2.	http://www.icisclab.com/userfiles/file/download/Verilog%20HDL%20Synthesis%20A%20Practical%20Primer.pdf	
3.	https://www.ucursos.cl/usuario/9553d43f5ccbf1cca06cc02562b4005e/mi_blog/r/CMOS_Circuit_Design__Layout__and_Simulation__3rd_Edition.pdf	

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SUBJECT CODE & NAME: U19EC630 – MINI PROJECT **SEMESTER-VI**

Course Outcome:
After completing this course, students will able to:

CO1: Demonstrate a sound technical knowledge of their selected mini project topic.
CO2: Undertake problem identification, formulation and solution.
CO3: Design engineering solutions to complex problems utilising a systems approach.
CO4: Demonstrate the knowledge, skills and attitudes of a professional Engineer.
CO5: Write technical report by applying different visualization tools and Evaluation metrics.

CO / PO Mapping (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**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2	3	2	2	3	-	-	2	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3
CO 3	3	3	3	2	3	-	-	2	2	2	2	3	2	2	3
CO 4	3	-	-	3	3	-	-	2	2	2	3	3	2	2	2
CO 5	2	-	-	1	3	3	3	2	2	-	2	3	2	3	2

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VII**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19BA701	**Principles of Management**	3	0	0	3	40	60	100

Course Objective

- To Study the evolution of management
- To Find out the functions and principles of management
- To Learn the application of the principles in an organization
- To Analyze the individual and group communication
- To learn the different principles and techniques of management in planning, organizing, directing and controlling.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Analyze science and evolution of management	K4
	CO2: Disseminate the basic functions and principles of management	K3
	CO3: Realize the application of the principles in an organization	K2
	CO4: Expose to interface the individual and group communication	K3
	CO5: Asses the various controlling and theories of leadership	K2
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 – Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	2								3	2	
CO 2	3	3	2	2	1	2						2	3		
CO 3	3	3	2	2	1	2	2	1					3	2	
CO 4	3	2	2	2	2		2		2	2		2	3		2
CO 5	3	2	2		2						2		3		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**	Periods	**9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-

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public and private sector enterprises - Organization culture and Environment – current trends and issues in Management.			
Unit – II	**PLANNING**	Periods	**9**
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques– Decision making steps and process.			
Unit – III	**ORGANISING**	Periods	**9**
Nature and purpose – Formal and informal organization – organization chart – organization structure– types –Line and staff authority – departmentalization – delegation of authority – centralization and decentralization– Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.			
Unit – IV	**DIRECTING**	Periods	**9**
Foundations of individual and group behavior – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.			
Unit – V	**CONTROLLING**	Periods	**9**
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.			
		Total Periods	**45**

Text Books	
1.	Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert ,"Management", Pearson Education, 6th Edition 2004.
References	
1.	Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", Pearson Education, 7th Edition,2011.
2.	Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3.	Harold Koontz & Heinz Weihrich, "Essentials of management",Tata Mc Graw Hill,2010.
4.	P.C.Tripathi,P N Reddy &Ashish Bajpai, "Principles of Management",Mc Graw Hill,7th Edition,2021
E-Resources	
1.	https://www.pearsonhighered.com/assets/preface/0/1/3/6/0136715303.pdf
2.	http://fmcet.in/AUTO/MG6851_uw.pdf
3.	https://hostnezt.com/cssfiles/businessadmin/Management%20by%20Robins%2011th%20ed.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VII**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC731	**RF and Microwave Engineering**	3	0	0	3	40	60	100

Course Objective	• To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues • To inculcate understanding of the basics required for circuit representation of RF networks • To deal with the issues in the design of microwave amplifier • To instill knowledge on the properties of various microwave components • To deal with the microwave generation and microwave measurement techniques	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world	K3
	CO2: Explain the active & passive microwave devices & components used in Microwave communication systems	K2
	CO3: Analyze the multi- port RF networks and RF transistor amplifiers.	K4
	CO4: Generate Microwave signals and design microwave amplifiers.	K3
	CO5: Measure and analyze Microwave signal and parameters.	K3
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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										3		
CO 2	3	3	2	2									3	2	
CO 3	3	3	2	2									3		
CO 4	3	2	2	2									3	2	2
CO 5	3	2	2										3		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**TWO PORT NETWORK THEORY**	Periods	**9**

Low frequency parameters-impedance, admittance, hybrid and ABCD. High frequency parameters-

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Formulation of S parameters, properties of S parameters-Reciprocal and lossless networks, transmission matrix, Introduction to component basics, wire, resistor, capacitor and inductor			
Unit – II	**RF AMPLIFIERS DESIGN AND MATCHING NETWORKS**	Periods	**9**
Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization Methods, Noise Figure, Constant VSWR, Broadband, High power and Multistage Amplifiers, Impedance matching using discrete components, Two component matching Networks, Frequency response and quality factor, T and Pi Matching Networks, Microstrip Line Matching Networks.			
Unit – III	**PASSIVE AND ACTIVE MICROWAVE DEVICES**	Periods	**9**
Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottkey diode detector and mixers, PIN diode switch,Varactor diode, Introduction to MIC.			
Unit – IV	**MICROWAVE GENERATION**	Periods	**9**
High frequency effects in Tubes, Two cavity klystron amplifier; Reflex klystron oscillator; TWT amplifier, Backwards wave oscillator; Magnetron oscillator – Theory and applications. Solid state devices: Gunn diode oscillator; BARITT, TRAPATT and IMPATT diode oscillator and amplifier, YIG Devices (Yttrium-Iron Garnet).			
Unit – V	**MICROWAVE MEASUREMENTS**	Periods	**9**
Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.			
		Total Periods	**45**
Text Books			
1.	Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design: Theory and Applications", Pearson Education Inc., 2013.		
2.	Robert E.Colin, "Foundations for Microwave Engineering", Wiley India, 2nd Edition, 2011		
References			
1.	David M. Pozar, "Microwave Engineering", Wiley India (P) Ltd, New Delhi, 2012.		
2.	Thomas H Lee, "Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits", Cambridge University Press, 2012.		
3.	Samuel Y .Liao, "Microwave Devices and Circuits", Pearson Education, 3rd Edition, 2012.		
4.	Annapurna Das and Sisir K Das, "Microwave Engineering", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2010.		
E-Resources			
1.	https://padeepz.net/ec6701-rf-and-microwave-engineering		
2.	https://drive.google.com/file/d/1CK4DJE4gmKFSADuE_1DL8RuYPiMOoViJ/view		
3.	https://radfiz.org.ua/share/sheva_s8_DEK/SECONDARY/%E4%C5%D2%D6/%E4%C5%D2%D6/%CE%D7%DE%20%D4%C5%C8%CE%A6%CB%C1/%CC%A6%D4/Collin.%20Foundations%20for%20Microwave%20Engineering.pdf		

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VII**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19EC732	**High Frequency Communication and Simulation Laboratory**	0	0	2	1	60	40	100

Course Objective	The student should be made, • To Measure S-parameters in microwave components. • To study the radiation pattern. • To design and simulate microwave components and circuits using ADS software • To Test the performance of microwave components	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: understanding microwave components principles	K2
	CO2: analyzing radiation pattern of antenna.	K3
	CO3: Design and simulation of microwave components	K3
	CO4: Design and simulation of microwave circuits	K3
	CO5: understanding optimization methods	K2
Pre-requisites	-	

CO / PO Mapping (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	**3**		2					3			3		2
CO 2	3	3			2	**3**								2	
CO 3	3		3		2					2			3		
CO 4	3	3			3	3								2	2
CO 5	3	3			3					2			3		

Course Assessment Methods

Direct
1. Pre lab and Post lab Test. 2. Assignment **3.** End-Semester examinations
Indirect
1. Course - end survey.

Content of the syllabus

List of Experiments

	Course Outcome

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1.	Mode characteristics of Reflex klystron and basic microwave parameter Measurement Such as VSWR, frequency, wavelength.	CO1
2.	VI - characteristics of Gunn diode	CO1
3.	Directional Coupler Characteristics.	CO1
4.	Radiation Pattern of Horn Antenna.	CO2
5.	S-parameter Measurement of the following microwave components (Isolator, Circulator, E-plane Tee, H Plane Tee, Magic Tee)	CO1
6.	Attenuation and Power Measurement	CO1
7.	Design and simulation of Microwave components using ADS	CO3
8.	Design and simulation of Microwave Circuits using ADS	CO4
9.	Design and simulation of microwave filters using ADS	CO4
10.	Tuning and Optimization of Microwave filters using ADS	CO5
	Total Periods	**45**

Text Books	
1.	Robert E.Colin, "Foundations for Microwave Engineering", Wiley India, 2nd Edition, 2011
2.	David M. Pozar, "Microwave Engineering", Wiley India (P) Ltd, New Delhi, 2012.
E-Resources	
1.	https://padeepz.net/ec6701-rf-and-microwave-engineering
2.	https://drive.google.com/file/d/1CK4DJE4gmKFSADuE_1DL8RuYPiMOoViJ/view
3.	https://radfiz.org.ua/share/sheva_s8_DEK/SECONDARY/%E4%C5%D2%D6/%E4%C5%D2%D6/%CE%D7%DE%20%D4%C5%C8%CE%A6%CB%C1/%CC%A6%D4/Collin.%20Foundations%20for%20Microwave%20Engineering.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VII**
Course Code	Course Name				
U19EC733	**Internship Training and Summer Project**				

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Gain industrial experience and to apply them in practical form	K2
	CO2: Understand the modern tools used in the field of electronics and communication engineering for product development	K2
	CO3: Deliver an effective presentation and inculcate team work ethics	K3
	CO4: Apply engineering and management values to accomplish project ambitions	K3
	CO5: Write an effective internship report and to do mini project	K3
Pre-requisites	-	

CO / PO Mapping (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**	**PS O1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	2	2	-	2	-	3	-	-	3	3	3	3
CO 2	2	3	3	3	2	-	-	-	-	-	-	3	3	3	3
CO 3	3	3	3	3	3	-	-	2	-	-	-	3	2	2	2
CO 4	3	2	3	3	2	-	1	-	-	-	-	3	3	2	1
CO 5	3	3	3	2	2	1	1	1	-	-	-	3	3	3	3

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SUBJECT CODE & NAME: U19EC834 - PROJECT WORK **SEMESTER-VIII**

Course Outcome:
After completing this course, students will able to:

CO1: Demonstrate a sound technical knowledge of their selected project topic.
CO2: Undertake problem identification, formulation and solution.
CO3: Design engineering solutions to complex problems utilising a systems approach.
CO4: Demonstrate the knowledge, skills and attitudes of a professional Engineer.
CO5: Write technical report by applying different visualization tools and Evaluation metrics.

CO / PO Mapping (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**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2	3	2	2	3	-	-	2	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3
CO 3	3	3	3	2	3	-	-	2	2	2	2	3	2	2	3
CO 4	3	-	-	3	3	-	-	2	2	2	3	3	2	2	2
CO 5	2	-	-	1	3	3	3	2	2	-	2	3	2	3	2

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Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV11	**Analog IC Design**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Demonstrate the feedback systems used in an amplifier.
- Evaluate the various frequency compensation techniques.
- Choose the suitable technique for the design of op-amp and CMRR
- Analyze the Single stage and two stage op-amp circuit
- Design and analyze of PLL and Jitter noise

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Understand the feedback systems used in an amplifier and analyze the Nyquist criterion in feedback system.	K2
CO2: Compare various frequency compensation techniques.	K2
CO3: Analyze the technique used to design any op-amp and CMRR	K3
CO4: Realize the Single stage and two stage op-amp circuit	K3
CO5: Design and analyze of Fully differential Op-amp and PLL	K4

Pre-requisites -

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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**
CO1	3	3	2					2				2	3	3	
CO2	3	3	2	2									2	2	
CO3	3	3	2	2								2	3	2	2
CO4	3	2	2	2				2				1		2	
CO5	3	2	2					2		2		1	3	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

Content of the syllabus

Unit – I	**INTRODUCTION AND NEGATIVE FEEDBACK**	Periods	**9**

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	SYSTEMS		
Introduction, Negative feedback amplifier using an integrator; Frequency and time domain behavior; Loop gain and its implications; Negative feedback amplifier realization; Finite DC gain; Increasing DC gain; Effect of multiple poles; Negative feedback systems with multiple poles and zeros in the forward path; Nyquist criterion; Stability analysis using Nyquist criterion.			
Unit - II	**OPAMP AND FREQUENCY COMPENSATION**	Periods	**9**
Concept of the Op-amp for realizing negative feedback circuits; Realizing a multi stage Op-amp-frequency compensation-miller Op-amp; Realizing a multi stage Op-amp; feed forward compensated Op-amp; Op-amp as a general block; unity gain compensation; non idealities swing limits, slew rate, offset; dc negative feedback around Op-amps.			
Unit – III	**OP-AMP AMPLIFIERS**	Periods	**9**
Amplifiers using Miller compensated Op-amp; Effect of input capacitance; gain bandwidth product; Trans-impedance amplifier; lead-lag compensation; Inverting and non-inverting amplifiers-CMRR and its importance.			
Unit - IV	**SINGLE ENDED OPAMP DESIGN**	Periods	**9**
Realizing a single stage op -amp-differential pair; small signal ac analysis; Single stage Op-amp-mismatch and noise; Single stage Op-amp-telescopic cascode; Replica biasing a cascode; Single stage Op-amp-folded cascode; Two stage miller compensated Op-amp; Three stage Op-amp; CMRR of an Op-amp and Op-amp circuits.			
Unit – V	**FULLY DIFFERENTIAL OPAMP DESIGN AND PHASE LOCKED LOOP**	Periods	**9**
Fully differential Op-amps; Differential and common mode half circuits; common mode feedback; Fully differential miller compensated Op-amp-common mode feedback loop and its stability; Phase locked loop; Lock range limitations; type II loop; Jitter & Phase noise; Continuous time approximation; PLL transfer functions; Reference feed through spurs; LC oscillators.			
		Total Periods	**45**

Text Books	
1.	Jim Williams, Newnes, "Analog Circuit Design: Art, Science and Personalities" (EDN Series for Design Engineers) (Paperback), Reprint Edition, 2015.
2.	David Johns and Ken Martin, "Analog Integrated Circuit Design", John Wiley & Sons, 2011.
References	
1.	Gray, Hurst, Lewis, and Meyer:, "Analysis and design of Analog Integrated Circuits", 4th Edition, John Wiley and Sons, 2009.
2.	Y. Tsividis, "Mixed Analog Digital VLSI Devices and Technology (An introduction), World Scientific", New Jersey, 2002.
3.	K. R. Laker and W.M.C.Sansen, "Design of Analog Integrated Circuits and Systems", McGraw-Hill, January 1994.
4.	Willy Sansen , **"**Analog Design Essentials:", Springer, 2006
5.	B.Razavi, **"**Design of CMOS Analog Integrated Circuits", Tata McGraw Hill, 2002.
E-Resources	
1.	https://hobbydocbox.com/Radio/86188550-World-electronics-free-wireless-world-audio-design-new-punch-to-speech-processing-windows-shopping-for-electronics-audio-on-a-postage-stamp.html
2.	https://xdevs.com/doc/_Books/ASIC_Design/analog%20integrated%20circuits%20design%20(johns,martin-1997).pdf
3.	https://dl.acm.org/doi/10.5555/574951
4.	https://archive.nptel.ac.in/courses/117/106/117106030

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV12	**System-on-Chip Design**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Introduce the overall System on Chip (SoC) Design flow.
- Apply and implement the concepts of System on Chip Design methodology for Processor Architecture
- Explore the concepts of System on Chip design core structures
- Study the Hardware & Software co-design process
- Learn the process of Real-time operating system

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Comprehend the SoC design methods	K2
	CO2: Validate the concepts of various SoC processors	K2
	CO3: Understand the System level architectures and algorithms	K4
	CO4: Analyze the factors of co design process	K4
	CO5: Understand the SoC design and simulation process	K4
Pre-requisites	**Embedded Systems, Real Time Operating Systems**	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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**
CO 1	3	3	2		1							1	3	2	
CO 2	3	3	2	2						2		1	3		2
CO 3	3	3	2	2								1	3	2	
CO 4	3	2	2	2						2		1	3		2
CO 5	3	2	2		2					2		1	3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**6**

Driving Forces for SoC - Components - Generic template- Design flow of SoC- Hardware/Software nature- Design Trade- Offs-Major Applications.

Unit – II	**SYSTEM-LEVEL DESIGN**	Periods	**10**

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Processor selection-Concepts in Processor Architecture: Instruction set architecture (ISA), elements in Instruction Handing-Robust processors: Vector processor, VLIW, Superscalar, CISC, RISC—Processor evolution: Soft and Firm processors, Custom-Designed processors-IP based design- on-chip memory.			
Unit – III	**SYSTEM-LEVEL INTERCONNECTION**	Periods	**10**
On-chip Buses: basic architecture, topologies, arbitration and protocols, Bus standards: AMBA, Core Connect, Wishbone, Avalon-Network-on-chip: Architecture-topologies-switching strategies-routing algorithms-flow control, quality-of-service-Reconfigurability in communication architectures.			
Unit – IV	**CO-DESIGN CONCEPTS**	Periods	**10**
Nature of hardware & software- quest for energy efficiency- driving factors for hardware-software codesign- Codesign space-Dualism of Hardware design and Software design-Modeling Abstraction Level-Concurrency and Parallelism- Hardware Software tradeoffs- Introducing Dataflow modeling			
Unit – V	**SoC IMPLEMENTATION**	Periods	**9**
Study of Microblaze RISC processor - Real-time operating system (RTOS), peripheral interface and components, High-density FPGAs-Introduction to tools used for SOC design: Xilinx SoC based development kit.			
		Total Periods	**45**
Text Books			
1.	Michael J.Flynn, Wayne Luk, "Computer system Design: System-on-Chip", Wiley-India, 2012.		
2.	Sudeep Pasricha, NikilDutt, "On Chip Communication Architectures: System on Chip Interconnect", Morghan Kaufmann Publishers, 2008		
References			
1.	W.H.Wolf, "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.		
2.	Patrick Schaumont "A Practical Introduction to Hardware/Software Co-design", Patrick Schaumont, 2nd Edition, Springer, 2012.		
3.	Lin, Y-L.S. (ed*.), "*Essential issues in SOC design: Designing Complex Systems-on-Chip. Springer, 2006.		
E-Resources			
1.	https://nptel.ac.in/courses/108102045/10 CO-ORDINATED BY : IIT Delhi		
2.	https://nptel.ac.in/courses/108102045/29CO-ORDINATED BY : IIT Delhi		

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV13	**Semiconductor Device Modeling**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Provide the knowledge about basics of Device Physics
- Enhance commanding skillfulness of students through understanding of MOSFET devices
- Introduce and motivate students to use the advanced CMOS devices
- Describes the foundation for forthcoming Bipolar Devices courses
- Learn about the technological importance of forthcoming Bipolar Devices design.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the operation of various MOS device modeling	K2
	CO2: Illustrate the operation of MOSFET and its characteristics	K3
	CO3: Analyze the operation of CMOS characteristics	K3
	CO4: Extend the operation of Bipolar devices	K2
	CO5:Explore the operation and characteristics of various Bipolar Device Design and display devices.	K2
Pre-requisites	-	

CO / PO Mapping (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	2	1						1		1	3	2	
CO 2	3	3										1	3		2
CO 3	3	2		1						1		1	3	2	
CO 4	3		2										3		2
CO 5	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

Content of the syllabus

Unit – I	**Basic Device Physics**	Periods	**9**

Electrons and holes in silicon, p-n junction, MOS capacitor, High field effects, BJT modeling: Ebers – Moll, Static, large-signal, small- signal models. Gummel – Poon model. Temperature and area effects.

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Unit – II	MOSFET Devices	Periods	9
Long-channel MOSFETs, Short-channel MOSFETs. CMOS Device Design: MOSFET Scaling, Threshold voltage, MOSFET channel length.			
Unit – III	**CMOS Performance Factors**	Periods	**9**
Basic CMOS circuit elements, Parasitic elements, Sensitivity of CMOS delay to device parameters, Performance factors of advanced CMOS devices.			
Unit – IV	**Bipolar Devices**	Periods	**9**
N-P-N Transistors, Ideal current-voltage characteristics, Characteristics of a typical n-p-n transistor, Bipolar device models for circuit and time-dependent analyses, Breakdown voltages.			
Unit – V	**Bipolar Device Design**	Periods	**9**
Design of the emitter design, Design of the base region, Design of the collector design, Modern bipolar transistor structures.			
		Total Periods	**45**

Text Books	
1.	Yuan Taur, Tak.H.Ning, Fundamentals of Modern VLSI Devices, Cambridge University Press, 2rd edition 2018.
2.	Donald Neamen, Semiconductors Physics and Devices, Tata McGraw Hill, 2003
3.	M. Rudolph, Introduction to Modeling HBTs, Artech House, Boston, 2006.
References	
1.	Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002.
2.	Semiconductor Devices, Basic Principles Jasprit Singh, Wiley Publications, 2001
3.	S.M. Sze (Ed), Physics of Semiconductor Devices, 2nd Edition, Wiley Publications, 2005
4.	Analysis And Design Of Analog Integrated Circuits 4/E, Paul R. Gray, Paul J. Hurst, Robert G Meyer, 2001, Wiley Publications
5.	Physics of Semiconductor Devices 3/e S. M. Sze, Wiley Publications, 2007.
E-Resources	
1.	http://www.ecerelatedbooks.com/2018/03/fundamentals-of-modern-vlsi-devices-by.html
2.	http://www.fulviofrisone.com/attachments/article/403/Semiconductor%20Physics%20And%20Devices%20-%20Donald%20Neamen.pdf
3.	https://pdflife.one/download/4660813-semiconductors-m-s-tyagi

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV14	**ASIC Design**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To learn different programmable ASICs, logic cells
- To study I/O cells and interconnects
- To explore modeling of Programmable Interconnects and Logic Synthesis.
- To study FPGA partitioning, Floor planning and Placement
- To study about the routing

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Infer the different types of ASICs design, CMOS characteristics and programming technologies	K2
	CO2: Realize the digital logic functions using programmable ASIC and I/O cells	K2
	CO3: Infer the different programmable interconnects and synthesis	K2
	CO4: Apply algorithms for partitioning, floor planning and placement	K3
	CO5:Perform routing design in an ASIC	K3
Pre-requisites	To learn different programmable ASICs, logic cells, I/O cells and interconnects and to perform synthesis and physical design flow in ASIC design	

CO / PO Mapping
(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	**2**	**1**						**2**				**1**	**1**		
CO 2	**2**	**1**	**1**					**2**				**2**	**1**		
CO 3	**2**	**1**	**2**	**2**				**2**				**2**	**2**	**2**	
CO 4	**3**	**3**	**3**	**2**	**2**		**2**	**3**				**2**	**3**	**2**	**2**
CO 5	**3**	**3**	**3**	**2**	**2**		**2**	**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

Content of the syllabus

Unit – I	**Introduction to ASICs, CMOS Logic, ASIC Library Design:**	Periods	**9**

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Types of ASICs - Design flow – CMOS transistors- Transistor as resistors - Transistor parasitic capacitance – Logical effort-Antifuse - Static RAM - EPROM and EEPROM technology			
Unit – II	**Programmable ASICs and I/O Cells**	Periods	**9**
Actel ACT - Xilinx LCA - DC & AC inputs and outputs – Clock & power inputs			
Unit – III	**Programmable Interconnects and Logic Synthesis**	Periods	**9**
Actel ACT – Xilinx LCA - Verilog logic synthesis – Delays, Blocking and Non blocking assignment, Combinational logic, multiplexers, Case statement, decoders, arithmetic and Sequential logic			
Unit – IV	**Partitioning, Floor planning and Placement**	Periods	**9**
Physical design flow -System partitioning - FPGA partitioning : KL algorithm –Floor planning –Types –Placement – Constructive and iterative placement algorithms			
Unit – V	**Routing**	Periods	**9**
Global routing - Detailed routing –Area routing-Maze Algorithm-Channel routing- Left Edge Algorithm-Special routing			
Text Books			
1.	Smith M.J.S., "Application Specific Integrated Circuits", 12th Edition, Pearson Education Pvt. Ltd., New Delhi, 2013.		
2.	Steve Kilts, “Advanced FPGA Design: Architecture, Implementation, and Optimization” Wiley Inter-Science, 2016		
3.	Roger Woods, John McAllister, Gaye Lightbody, Dr. Ying Yi “ FPGA-based Implementation of Signal Processing Systems”,2nd Edition, Wiley, 2017		
References			
1.	D. Brown, R.J. Francis, J. Rox, Z.G. Uranesic, “ Field Programmable Gate Arrays”, Kluwer Academic Publishers, 2014.		
2.	Wayne Wolf, "FPGA-Based System Design", 1st Edition, PHI, New Delhi, 2009.		
3.	Erik larson, "Introduction to Advanced System-on-Chip Test Design and Optimization", 1st Edition, Springer, USA, 2005.		
4.	Jose E. France, YannisTsividis, “Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing”, Prentice Hall, 2013.		
E-Resources			
1.	https://d1.amobbs.com/bbs_upload782111/files_9/ourdev_212152.pdf		
2.	https://www.multisoftsystems.com/embedded-systems/asic-design-verification-training		
3.	https://nptel.ac.in/courses/106106089/magma_tutorial/magma_tutorial.html		

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Programme	**B.E**	Programme Code	103	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV15	**Low Power VLSI Design**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To study the principle of low power design.
- To study the Power dissipation in CMOS.
- To explore the concept of power optimization and estimation analysis.
- To understand the layout design and special techniques
- To study the software design for low power techniques.

Course Outcomes	At the end of the course, the student should be able to	Knowledge Level
	CO1: Enumerate different source of power dissipation and the factors involved	K1
	CO2: Analyze various power optimization technique at circuit level	K4
	CO3: Design of low power circuits at architecture level	K4
	CO4: Use of Simulation and probabilistic method of power analysis	K3
	CO5: Perform power estimation and optimization at programming level	K4

Pre-requisites	To design the combinational and sequential circuits with minimum power consumption and to anlayse the various power optimization methods and techniques to reduce power consumption.

CO / PO Mapping
(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	2	3	2	3								2	3	2	
CO 2	3	3	2	2								2	3	2	
CO 3	3	3	3	2	2		1					2	2	2	
CO 4	3	3	2	2	2		1					2	1	2	
CO 5	3	3	3	2	2		1					2	2	2	

Course Assessment Methods

Direct

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

Indirect

4. Course – end survey

Content of the syllabus

Unit – I	**POWER DISSIPATION IN CMOS**	Periods	**9**

Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices- Basic principle of low power design.

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Unit – II	**POWER OPTIMIZATION**	Periods	**9**
Logical level power optimization – Circuit level low power design – Circuit techniques for reducing power Consumption in adders and multipliers.			
Unit – III	**DESIGN OF LOW POWER CMOS CIRCUITS**	Periods	**9**
Computer Arithmetic techniques for low power systems – Reducing power consumption in memories – Low power clock, Interconnect and layout design – Advanced techniques – Special techniques.			
Unit – IV	**POWER ESTIMATION**	Periods	**9**
Power estimation techniques – Logic level power estimation – Simulation power analysis– Probabilistic power analysis.			
Unit – V	**SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER**	Periods	**9**
Synthesis for low power –Behavioral level transforms- Sources of Software Power dissipation- Power Estimation- Power Optimization			
		Total Periods	**45**

Text Book	
1.	Kaushik Roy, Sarat.C.Prasad, Low power CMOS VLSI circuit design, 1st reprint, Wiley India, 2009.
2.	DimitriosSoudris, ChirstianPignet, Costas Goutis, “Designing CMOS Circuits for Low Power”,Kluwer Academic Publishers, 2010

References	
1.	J.B. Kuo and J.H Lou, “Low Voltage CMOS VLSI Circuits”, Wiley 1999.
2.	A.P.Chandrakasan and R.W. Broadersen, “Low Power Digital CMOS Design”, Kluwer Academic Publishers , 1995.
3.	Gary Yeap, “Practical Low Power Digital VLSI Design”, Kluwer, 1998.
4.	Abdellatif Bellaouar, Mohamed.I. Elmasry, “Low Power Digital VLSI Design”, Kluwer Academic Publishers, 1995.
5.	James B. Kuo, Shin – chia Lin, “Low Voltage SOI CMOS VLSI Devices and Circuits”,John Wiley & sons, Inc 2001.

E-Resources	
E1	https://nptel.ac.in/courses/106105161/58 Prof.Indiranilsengupta
E2	https://nptel.ac.in/courses/106105034/19 Prof.Ajit Pal
E3	https://archive.nptel.ac.in/courses/106/105/106105034/38

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV16	**Foundations of VLSI CAD**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To provide an introduction to the fundamentals of Computer-Aided Design tools for the modeling, design, analysis, test, and verification of digital Very Large Scale Integration (VLSI) systems.
- To understand the advanced techniques for solving computer-aided design problems for a wide range of design styles.
- To Analysis different types of floor planning, placement and routing algorithms.
- To learn the two level logic synthesis and binary decision diagrams.
- To learn different Scheduling Algorithms

Course Outcome

At the end of the course, the student should be able to	Knowledge Level
CO1: Establish comprehensive understanding of the various phases of CAD for digital electronic systems, from digital logic simulation to physical design, including test and verification	K3
CO2: Analyze the physical design process of VLSI design flow	K4
CO3: Demonstrate knowledge of computational and optimization algorithms and tools applicable to solving CAD related problems.	K5
CO4: Establish capability for CAD tool development and enhancement.	K3
CO5: Explore the hardware modeling and high level transformation	K2

Pre-requisites

CO / PO Mapping
(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	3										2	
CO 2	3	3	2	3								2		2	2
CO 3	3	3	2	3						2		2	3	2	
CO 4	3	3	2	2						2			3		2
CO 5	3	2	2	2						2			3		

Course Assessment Methods

Direct

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

Indirect

1. Course – end survey

Content of the syllabus

Unit – I	**VLSI DESIGN METHODOLOGIES**	Periods	**9**

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Introduction to VLSI Design methodologies – Review of Data structures and algorithms –Review of VLSI Design automation tools – Algorithmic Graph Theory and Computational Complexity – Tractable and Intractable problems – general purpose methods for combinatorial optimization.			
Unit – II	**DESIGN RULES**	Periods	**9**
Layout Compaction – Design rules – problem formulation – algorithms for constraint graph compaction – placement and partitioning – Circuit representation – Placement algorithms – partitioning.			
Unit – III	**FLOOR PLANNING**	Periods	**9**
Floor planning concepts – shape functions and Floor plan sizing – Types of local Routing problems – Area routing – channel routing – global routing – algorithms for global routing.			
Unit – IV	**SIMULATION**	Periods	**9**
Simulation – Gate-level Modeling and simulation – Switch-level Modeling and simulation- Combinational Logic Synthesis – Binary Decision Diagrams – Two Level Logic Synthesis.			
Unit – V	**MODELLING AND SYNTHESIS**	Periods	**9**
High level Synthesis – Hardware models – Internal representation – Allocation –assignment and scheduling – Simple scheduling algorithm – Assignment problem – High level transformations.			
		Total Periods	**45**
TEXT BOOK			
1.	S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons,2019		
References			
1.	N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.		
E-Resources			
E1	https://nptel.ac.in/courses/108102042/CO-ORDINATED BY : IIT DELHI		
E2	https://nptel.ac.in/courses/106102062/ CO-ORDINATED BY : IIT DELHI		
E3	https://drive.google.com/file/d/0BzoKWH8M1BoTVnBham5ENGZCUE0/view?usp=sharing&resourcekey=0-fap9ekmWbZ0tZKnlXamzUg		

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV17	**Introduction to MEMS**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Understand the MEMS miniature devices in the consumer products.
- Elaborate the MEMS design, fabrication, sensing and actuation mechanisms, characterization and reliability testing.
- Acquire knowledge in the types and procedures involved in MEMS fabrication.
- Investigate various applications of MEMS.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: An ability to analyze MEMS miniature devices in the consumer products	K3
	CO2: An ability to design a system, component, or analyze the process	K3
	CO3: Understand the concept of the Opto-electro mechanical components and system	K3
	CO4: An ability to design various types of sensors in MEMS.	K3
	CO5: Made aware of micro fluid systems and its the applications.	K2
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	3				2		2		2	3	2	
CO 2	3	3	2	2				2		2	2		3	2	2
CO 3	3	3	2	2				2		2	2	2	3	2	2
CO 4	3	2	2	2				2		2		2	3		2
CO 5	3	2	2	2				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

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA. MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS

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gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.			
Unit – II	**THERMAL SENSORS AND ACTUATORS**	Periods	**9**
Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.			
Unit – III	**MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS**	Periods	**9**
Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.			
Unit – IV	**MAGNETIC SENSORS AND ACTUATOR**	Periods	**9**
Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.			
Unit – V	**MICRO FLUIDIC SYSTEMS**	Periods	**9**
Applications, considerations on micro scale fluid, fluid actuation methods, dielectrophoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps. RADIO FREQUENCY (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.			
		Total Periods	**45**
Text Books			
1.	Fundamental of MEMS by N.P.G.S Mahalik, TMH		
2.	Foundations of MEMS by Chang Liu (2nd edition), 2012, PHI		
3.	MEMS, NitaigourPremchandMahalik, TMH Publishing co.		
References			
1.	MEMS and Microsystems (2nd edition) by Tai-Ran Hsu, 2008. Wielly& sons		
2.	Microsystem design by Stephen Senturia, Springers		
3.	Tai - Rai Hsu, "MEMS and Microsystems Design and Manufacturing", Tata MC Graw Hill, New Delhi, Edition 2002.		
4.	Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley and Sons, 2003.		
5.	NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse ,2000.		
E-Resources			
1.	https://download.e-bookshelf.de/download/0000/0100/00/L-G-0000010000-0002343073.pdf		
2.	https://www.pdfdrive.com/mems-and-microsystems-design-and-manufacture-d18778809.html		
3.	https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/BIOMEMS-MODULE1.pdf		

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Programme	**B.E**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV18	**VLSI For Wireless Communication**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To study the design concepts of low noise amplifiers.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of CDMA in wireless communication.

Course Outcome

At the end of the course, the student should be able to	Knowledge Level
CO1: Understand the design concepts of low noise amplifiers	K2
CO2: Understand the various types of mixers designed for wireless communication	K2
CO3: Identify and analyze the different techniques involved in design of PLL	K3
CO4: Identify and analyze the different techniques involved in design of VCO	K2
CO5: Study different concepts of CDMA in wireless communication.	K3

Pre-requisites -

CO / PO Mapping
(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**
CO 1	3	3	2	2									3	2	
CO 2	3	3	2	2									3	2	
CO 3	3	3	2	2									3	2	
CO 4	3	3	2	2									3	2	
CO 5	3	2	2	2									3	2	

Course Assessment Methods

Direct

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

Indirect

1. Course – end survey

Content of the syllabus

Unit – I	**COMPONENTS AND DEVICES**	Periods	**9**

Integrated inductors, resistors, MOSFET and BJT AMPLIFIER DESIGN: Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain Control Amplifiers – Power Amplifiers

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Unit – II	MIXERS	Periods	9
Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise - A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer			
Unit – III	**FREQUENCY SYNTHESIZERS**	Periods	**9**
Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example (DECT Application).			
Unit – IV	**UB SYSTEMS**	Periods	**9**
Data converters in communications, adaptive Filters, equalizers and transceivers			
Unit – V	**IMPLEMENTATIONS**	Periods	**9**
VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System.			
		Total Periods	**45**

Text Book	
1.	B.Razavi ,"RF Microelectronics" , Prentice-Hall ,2019.
2.	Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2015
References	
1.	Thomas H.Lee, "The Design of CMOS Radio –Frequency Integrated Circuits', Cambridge University Press ,2003.
2.	Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI Wireless Design - Circuits and Systems", Kluwer Academic Publishers, 2000.
3.	BehzadRazavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 1999..
4.	J. Crols and M. Steyaert, "CMOS Wireless Transceiver Design," Boston, Kluwer Academic Pub., 1997.
E-Resources	
E1	https://nptel.ac.in/courses/106105161/58 Prof.Indiranilsengupta
E2	https://nptel.ac.in/courses/106105034/19 Prof.Ajit Pal

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV21	**Digital Image Processing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Know basics of Digital Image Processing
- Study the formation of an image and its acquisition.
- Introduce the use and application of transforms in image processing.
- Study techniques for improving quality of information in splitting images
- To introduce schemes for compressing images to save storage space

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Understand the fundamentals of digital image processing.	K2
CO2: Differentiate image transforms.	K2
CO3: Apply various techniques for image enhancement and restoration techniques.	K4
CO4: Utilize appropriate preprocessing techniques for manipulation of images	K3
CO5: To become familiar and apply various image compression methods	K4

Pre-requisites: Mathematical knowledge

CO / PO Mapping
(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**
CO1	3	3	2					2					3	2	
CO2	3	3	2	2				2		2			3		2
CO3	3	3	2	2									3	2	
CO4	3	2	2	2				2		2			3		2
CO5	3	2	2							2			3	2	

Course Assessment Methods

Direct

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

Indirect

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1. Course - end survey

Content of the syllabus

Unit – I	**DIGITAL IMAGE FUNDAMENTALS**	Periods	**9**

Elements of digital image processing systems, steps in image processing, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, image sampling and quantization, relationship between pixels, mathematical tools used in image processing. 2D sampling, sampling theorem, aliasing and Moire patterns.

Unit - II	**IMAGE TRANSFORMS**	Periods	**9**

2D transforms - DFT, DCT, DST, Walsh, Hadamard, Slant and Haar wavelet transforms

Unit – III	**IMAGE ENHANCEMENT AND RESTORATION**	Periods	**9**

Intensity transformations, histogram processing, smoothing spatial filters, sharpening spatial filters. Image restoration: Degradation/ restoration process, noise models, noise probability distributions, spatial filtering, mean filters, order statistics filters. Estimating the degradation function, Inverse filtering, Wiener filtering, constrained least squares filtering.

Unit - IV	**IMAGE SEGMENTATION AND REPRESENTATION**	Periods	**9**

Point, line and edge detection, edge linking and boundary detection, thresholding – global, multiple and variable, multivariable thresholding, region growing, region splitting and merging. Image representation: Boundary following, chain codes, polygonal approximations, signatures, boundary segments and skeletons.

Unit – V	**IMAGE COMPRESSION**	Periods	**9**

Fundamentals, basic compression methods – Huffman coding, arithmetic coding, LZW coding, run length coding, block transform coding and wavelet coding, Digital image watermarking, JPEG standard, MPEG.

	Total Periods	**45**

Text Books

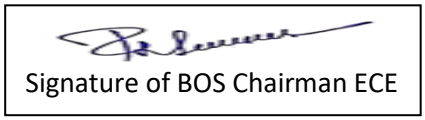
1.	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing", Pearson Prentice Hall, 3rd Edition, 2008.
2.	S. Annadurai and R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education, 2007.

References

1.	Anil K- Jain- 'Fundamentals of Digital Image Processing'- Pearson / Prentice Hall of India- 2012
2.	William K. Pratt, "Digital Image Processing", John Wiley, New York, 2002.
3.	Digital Image Processing , S Jayaraman, S Esakkirajan T Veerakumar, Mc Graw-Hill, 2010.
4.	Digital Image Processing, K.William Pratt, John Wiley, 1997.
5.	Image Processing Theory, Algorithm and Architectures, M.A.Sid Ahmed,McGraw-Hill, 1995.

E-Resources

1.	http://web.ipac.caltech.edu/staff/fmasci/home/astro_refs/Digital_Image_Processing_2ndEd.pdf
2.	https://www.cis.rit.edu/class/simg361/Notes_11222010.pdf
3.	http://ultra.sdk.free.fr/docs/DxO/Fundamentals%20of%20Digital%20Image%20Processing.pdf



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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV22	**Medical Image Processing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Understand the nuclear medical imaging techniques for acquisition of images.
- Realize the 2D and 3D transforms required for image reconstruction.
- Gain sound knowledge about CT, Fluoroscopy and Image quality.
- Understand the concepts of Neuro Magnetic Imaging and MRI
- Analyze the principle and operation modes of Ultrasound Imaging

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Identify the nuclear medical imaging techniques for acquisition of images	K2
	CO2: Apply 2D and 3D transforms required for image reconstruction	K3
	CO3: Analyze the x-ray medical imaging techniques and its imaging quality	K4
	CO4: understand the concept of Neuro Magnetic Science in MRI	K3
	CO5: Analyze the principle and operation modes of Ultrasound Imaging	K4
Pre-requisites	Knowledge on Mathematics	

CO / PO Mapping (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					2				2	3	2	
CO 2	3	3	2	2				2		2		2	3		2
CO 3	3	3	2	2								2	3	2	
CO 4	3	2	2	2				2		2		2	3		2
CO 5	3	2	2							2		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

Content of the syllabus

Unit – I	**ACQUISITION OF IMAGES**	Periods	**9**

Introduction to Imaging Techniques - Single crystal scintillation camera - Principles of scintillation camera - multiple crystal scintillation camera - solid state camera - rectilinear scanner- Emission

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computed Tomography.			
Unit – II	**MATHEMATICAL PRELIMINARIES FOR IMAGE RECONSTRUCTION**	Periods	**9**
Image Reconstruction from Projections in Two dimensions- Mathematical Preliminaries for Two and Three dimensional Image Reconstructions - Radon Transform- Projection Theorem - central slice Theorem- Sinogram- Two Dimensional Projection Reconstruction- Three Dimensional Projection Reconstruction- Iterative Reconstruction Techniques.			
Unit – III	**FLUOROSCOPY, CT, IMAGE QUALITY**	Periods	**9**
Digital fluoroscopy- Automatic Brightness control - cinefluorography- Principles of computed Tomographic Imaging - Reconstruction algorithms - Scan motions- X-ray sources. Influences of Images quality: Unsharpness- contrast - Image Noise.			
Unit – IV	**MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY**	Periods	**9**
Fundamentals of magnetic resonance- overview -Pulse techniques- spatial encoding of magnetic resonance imaging signal- motion suppression techniques- contrast agents- tissue contrast in MRI-FMRI.			
Unit – V	**ULTRASOUND, NEUROMAGNETIC IMAGING**	Periods	**9**
Ultrasound: Presentation modes- Time required to obtain Images- System components, signal processing dynamic Range- Ultrasound Image Artifacts- Quality control, Origin of Doppler shift- Limitations of Doppler systems.			
		Total Periods	**45**
Text Books			
1.	William R. Hendee, E. Russell Ritenour, Medical Imaging Physics: A John Wiley & sons, Inc., Publication, Fourth Edition 2002.		
2.	Z.H. Cho., J-oie, P. Jones and Manbir Singh,Foundations of Medical Imaging: John Wiley and sons Inc.		
References			
1.	Avinash C. Kak, Malcolm Shaney, "Principles of Computerized Tomographic Imaging", IEEE Press, Newyork-1998.		
2.	image Processing Theory, Algorithm and Architectures, M.A.Sid Ahmed,McGraw-Hill, 1995		
3.	Epstein, C. L. Mathematics of Medical Imaging. Upper Saddle River, NJ: Prentice Hall, 2003		
4.	Webb, S. The Physics of Medical Imaging. New York, NY: Taylor & Francis, 2018.		
5.	Macovski, A. Medical Imaging Systems. Upper Saddle River, NJ: Prentice Hall, 2018		
E-Resources			
1.	https://www.k-space.org/ymk/Hendee_Ultrasound_Imaging.pdf		
2.	https://cds.ismrm.org/ismrm-2001/PDF3/0758.pdf		
3.	https://dl.icdst.org/pdfs/files3/eeec98f44e7fd4241be41facb31e38a7.pdf		

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV23	**Biomedical Signal Processing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Understand and gain complete knowledge about the fundamentals of biomedical signal processing
- Develop a theoretical foundation of biomedical signal processing techniques.
- Provide analytic skills to process the ECG and EEG
- Develop analytic skills to algorithms for HRV and Arrhythmia analysis
- Understand the knowledge gained to model, analyse and predict various pathological conditions

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the fundamentals of biomedical signal processing and filters in time domain and frequency domain	K2
	CO2: Model the biomedical systems	K3
	CO3: Analyze EEG & ECG signals	K4
	CO4: Apply various algorithms for HRV and Arrhythmia analysis	K3
	CO5: Apply the knowledge gained to model, analyse and predict various pathological conditions	K3

Pre-requisites	-	

CO / PO Mapping (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**	**PS O1**	**PSO 2**	**PS O 3**
CO 1	3	2	2									2	2		
CO 2	2	3	2	2									2	2	
CO 3	2		3	3									3	3	
CO 4	2							2					2	2	
CO 5	3	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

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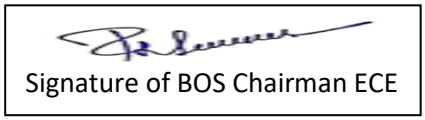
Content of the syllabus

Unit – I	INTRODUCTION	Periods	9
Biomedical Signals – Sources, Properties, Objectives and Difficulties in Biomedical Signal Analysis, Filtering for removal of artifacts – Time domain filters, Frequency domain filters, Optimal filtering.			
Unit – II	**MODELLING BIOMEDICAL SYSTEMS**	Periods	**9**
Pont process, Parametric System Modeling, All Pole Modeling, Pole-Zero Modeling, Spectral Modeling, Applications.			
Unit – III	**NEUROLOGICAL SIGNAL PROCESSING**	Periods	**9**
The Brain and its potentials; The Electrophysiology origin of brain waves; the EEG Signal and its characteristics; EEG analysis; Statistical parameter mapping of EEG signal; Linear prediction theory; The autoregressive (AR) method; Wiener filtering problem; Principle of an adaptive filter; Steepest – descent algorithm; Windrow-hoff least–mean-square adaptive algorithm.			
Unit – IV	**CARDIOLOGICAL SIGNAL PROCESSIN(**	Periods	**9**
Basic electrocardiography; ECG data acquisition; ECG lead system; ECG parameters and their estimation; Use of multi-scale analysis for parameters estimation of ECG waveforms, Adaptive noise canceller; Long term continuous ECG recording; The wavelet approximation – Discrete wavelet transform (DWT); Multi-resolution analysis; Pyramid algorithm.			
Unit – V	**HRV AND ARRHYTHMIA ANALYSIS**	Periods	**9**
Heart Rate variability; comparison of short-term and long term HRV analysis; Time domain and spectral domain parameters of short term recording.			
		Total Periods	**45**

Text Books	
1.	Rangaraj M.Rangayyan, “Biomedical Signal Analysis”, Wiley, 2015
2.	Kayvan Najarian and Robert Splinter, “Biomedical Signal and Image Processing”, 2nd Edition, CRC Press, 2012
References	
1.	D.C.Reddy, Biomedical Signal Processing Principles and Techniques, TATA McGraw-Hill Education, New Delhi, 2009.
2.	Arnon Cohen “Biomedical Signal Processing” Crc Pr I Llc; 2nd Edition, May, 2002.
3.	W.J.Tompkins, Biomedical Digital signal processing, Prentice Hall, New Jersey-1993.
4.	Tompkins W J “Biomedical Signal Processing”, Prentice hall of India, New Delhi, 1999.
5.	IEEE Engineering Medicine and Biology Magazine.
E-Resources	
1.	https://go-pdf.online/biomedical-signal-processing-by-d-c-reddy.pdf
2.	https://www.intechopen.com/books/8851#:~:text=Neural%20signal%20processing%20is%20a,of%20neuroscience%20and%20neural%20engineering.
3.	https://ocw.mit.edu/courses/hst-582j-biomedical-signal-and-image-processing-spring-2007/pages/lecture-notes/



VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV24	**Speech and Natural Language Processing**	3	0	0	3	50	50	100

Course Objective

The main objective of the course is to

- To learn production and classifications of speech.
- To learn different speech modeling and implementation issues
- To learn different speech recognition system and applications
- To learn the natural language processing algorithms and ambiguities
- To learn the natural language processing models and evaluation

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the production and classifications of speech signals	K2
	CO2: Understand different speech modeling and implementation issues	K2
	CO3: Understand different speech recognition system and applications	K2
	CO4: Understand natural language processing algorithms and ambiguities	K2
	CO5: Understand natural language processing models and evaluation	K2
Pre-requisites	-	

CO / PO Mapping (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**
CO 1	3	3	2	2	2	2						1	3	2	
CO 2	3	3	2	2	2	2						1	3		2
CO 3	3	3	2	2	2	2						1	3	2	
CO 4	3	3	2	2	2	2						1	3		2
CO 5	3	3	2	2	2	2						1	3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**BASIC CONCEPTS**	Periods	**9**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short- Time Fourier Transform, Filter-Bank and LPC Methods.

Unit – II	**SPEECH MODELING**	Periods	**9**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi

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Search, Baum-Welch Parameter Re-estimation, Implementation issues.			
Unit – III	**SPEECH RECOGNITION**	Periods	**9**
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.			
Unit – IV	**COMPUTER LANGUAGE PROCESSING AND REGULAR EXPRESSIONS**	Periods	**9**
Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms, Turing Test, Basic Regular Expression Patterns, Disjunction, Grouping, and Precedence, Example: Simple and Complex, Advanced Operators			
Unit – V	**TEXT TOKENIZATION AND NORMALIZATION AND LANGUAGE MODELING**	Periods	**9**
Words, Corpora, Word tokenization and normalization, Word segmentation, Sentence segmentation, Minimum edit distance algorithm N-Grams, Evaluating Language Modeling, Smoothing algorithm			
		Total Periods	**45**

Text Books	
1.	Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2012.
2.	L.R.Rabiner, R.W.Schafer, "Digital Processing Of Speech Signals", Pearson Education 4th Edition, 2009.
3	Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
4	Jurafsky, Daniel Martin & James H., "Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 3rd Edition, Pearson Education India, New Delhi, 2019.
References	
1.	Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 1997.
2.	Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition",Pearson Education, 2002.
3.	Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.
4.	Eisenstein & Jacob, "Natural Language Processing", 1st Edition, MIT Press, USA, 2019
5.	Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.
E-Resources	
1.	https://research.iaun.ac.ir/pd/mahmoodian/pdfs/UploadFile_2643.pdf
2.	http://mu.ac.in/wp-content/uploads/2014/04/SPEECH-RECOGNITION.pdf
3.	https://doc.lagout.org/science/0_Computer%20Science/9_Others/1_Digital%20Signal%20Processing/The%20Scientist%20and%20Engineer%27s%20Guide%20to%20DSP.pdf

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

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Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV25	**Digital Video Processing**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Demonstrate the difference between analog and digital video, usage of digital videos, how digital videos are acquired, stored, different video file formats and spatio-temporal imagery.	K2
	CO2: Perform techniques for motion analysis such as motion detection, estimation and compensation.	K3
	CO3: Apply video processing techniques such as enhancement, segmentation for dynamic imagery in order to perform higher level analysis	K3
	CO4: Learn fundamentals of video compression techniques and their applications	K4
	CO5: Identify as well as apply these techniques to solve real-world video applications and propose solutions for the same.	K3
Pre-requisites	-	

CO / PO Mapping (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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	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

Content of the syllabus

Unit – I	**DIGITAL VIDEO FORMATION**	Periods	**9**

Introduction to digital video and digital video processing, Analog

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versus Digital, Analog to Digital, Digital Video Standards- Video acquisition, CCD and CMOS Sensors, Video sampling and interpolation- Interlaced and Progressive scanning- Video file formats- Storage devices, NVR, DVR- Different types of Video Cameras, IP Camera			
Unit - II	**MOTION ANALYSIS**	Periods	**9**
Motion Detection – Hypothesis testing with Fixed/Adaptive thresholding Motion Estimation-Pixel based approaches- Block matching approaches- Motion compensation for videos			
Unit – III	**VIDEO ENHANCEMENT:**	Periods	**8**
Video artifacts – Spatio-temporal noise filtering- Order statistics filtering, Blotch detection and Removal			
Unit - IV	**GUARANTEED SERVICE MODEL**	Periods	**9**
Scene change detection- Motion segmentation- Video shot boundary detection- Motion tracking-contour based tracking- Feature based tracking			
Unit – V	**VIDEO COMPRESSION TECHNIQUES:**	Periods	**10**
Inter frame coding-MPEG-1,MPEG-2 and MPEG-4video compression standards – Low bit rate approaches- H.261 and H.264			
		Total Periods	**45**

Text Books	
1.	Yao.Wang, Jom Ostermann, & Ya-Oin Zhang, "Video Processing & Communications", Prentice Hall, 2002. (ISBN 0-13-017547-1)
2.	A. Murat Tekalp, "Digital Video Processing, Pearson Education", Prentice Hall, 2015. (ISBN-10: 0-13-399100-8)
References	
1.	Oge Marques, "Practical Image and Video Processing using MATLAB", Wiley-IEEE Press. 2011.
2.	H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia – Iain E.G. Richardson, Wiley, 2003
3.	Al Bovik, "Handbook of Image & Video Processing", Academic Press, 2000. (ISBN: 0121197905)
4.	J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", Academic Press, 2006. (ISBN 0-12-088516-6)
5.	lain E.G. Richardson, "H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia", Wiley, 2003. (ISBN: 978-0-470-86960-4)
E-Resources	
1.	*https://preetikale.files.wordpress.com/2018/07/handbook-of-image-and-video-processing-al-bovik1.pdf*
2.	https://yslaiseblog.files.wordpress.com/2013/10/gfx-multimedia-making-it-work-8th-edition.pdf
3.	https://doc.lagout.org/network/H.264%20and%20MPEG4%20Video%20Compression.pdf
4.	https://ptgmedia.pearsoncmg.com/images/9780133991000/samplepages/9780133991000.pdf
5.	https://books.google.co.in/books/about/Digital_Image_Sequence_Processing_Compre.html?id=tXqmDwAAQBAJ&redir_esc=y

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV26	**Radar Signal Processing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is
- To Demonstrate the basic principle and operation of radar parameters.
- To Classify the various types of noises present in the systems.
- To Select the waveforms from different pulses.
- To Construct compression ranges and their types.
  Illustrate the concept of phase coding over the wide ranges.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Determine the basic theory involved in radar systems.	K2
	CO2: Analyze the noise involved in the signal representation.	K2
	CO3: Summarize the ranges of radar systems.	K2
	CO4: Model the culture models and pulse compression.	K2
	CO5: Illustrate the concept of phase code.	K2
Pre-requisites	-	

CO / PO Mapping (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	2	2	2						1	3	2	
CO 2	3	3	2	2	2	2						1	3		2
CO 3	3	3	2	2	2	2						1	3	2	
CO 4	3	3	2	2	2	2						1	3		2
CO 5	3	3	2	2	2	2						1	3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

Radar Block Diagram, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance– General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, Bistatic Radar. Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and

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Cross-Correlation Receiver, Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.			
Unit – II	**DETECTION OF RADAR SIGNALS IN NOISE**	Periods	**9**
Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer, Detectors – Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection- CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management – Schematics, Component Parts, Resources and Constraints.			
Unit – III	**WAVEFORM SELECTION**	Periods	**9**
Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noise Like Waveforms, Waveform Design Requirements, Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.			
Unit – IV	**PULSE COMPRESSION IN RADAR SIGNALS**	Periods	**9**
Introduction, Significance, Types, Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Side lobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression.			
Unit – V	**PHASE CODING TECHNIQUES**	Periods	**9**
Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar. Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM),Side lobe Reduction for Phase Coded PC Signals.			
		Total Periods	**45**

Text Books	
1.	G. Richard Curry, "Radar System Performance Modeling", Volume 1, Artech House, 2nd Edition, 2015.
2.	M.I. Skolnik, "Introductions to Radar Systems", TMH, 3rd Edition, 2013.
References	
1.	Peyton Z. Peebles, "Radar Principles", John Wiley, 2014.
2.	Peyton Z. Peebles, "Radar Design Principles: Signal Processing and The Environment", PHI. 2nd Edition, 2013.
3.	R. Nitzberg, "Radar Signal Processing and Adaptive Systems", Artech House, 2014.
4.	M.I. Skolnik, "Radar Handbook", McGraw Hil , 2nd Edition, 2015.
5.	F.E. Nathanson, "Radar Design Principles", McGraw Hil ,2015.
E-Resources	
1.	http://202.91.76.90:81/fdScript/RootOfEBooks/ECE/David%20K.%20-%20Barton.%20Radar%20System%20Analysis%20and%20Modeling.pdf
2.	https://soaneemrana.org/onewebmedia/INTRODUCATION%20TO%20RADAR%20SYSTEM%20BY%20MERRIL,%20I%20SKLOINK%20%284%29.pdf
3.	https://www.wiley.com/en-us/exportProduct/pdf/9780471252054

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV27	**DSP Architecture and Programming**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Basics on Digital Signal Processors
- Programmable DSP's Architecture, On-chip Peripherals and Instruction set
- Programming for signal processing applications
- Advanced Programmable DSP Processors

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Comprehends the knowledge & concepts of Digital Signal Processing techniques.	K2
CO2: Make use of the knowledge of DSP computational building blocks and know how to achieve speed in DSPTMS320C5X processor.	K3
CO3: Implement the knowledge DSPTMS320C6X processor for computing real time programs.	K3
CO4: Compute various application programs of Advanced DSP Processor.	K3
CO5: Differentiate the features of TI's advanced processors.	K4

Pre-requisites -

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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 O 2**	**PS O 3**
CO1	2	-	-	-	-	-	-	-	-	1	-	-	1	1	-
CO2	2	-	-	-	-	-	-	-	-	2	-	-	2	2	-
CO3	3	-	-	-	-	-	-	-	-	2	-	-	2	2	-
CO4	2	2	-	-	-	-	-	-	-	2	-	-	2	2	-
CO5	2	-	-	-	-	-	-	-	-	2	-	-	2	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

Content of the syllabus

Unit – I	**Fundamentals Of Programmable DSPs**	Periods	**9**

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Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs.			
Unit - II	**TMS320C5X Processor**	Periods	**9**
Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals, Application Programs for processing real time signals.			
Unit – III	**TMS320C6X Processor**	Periods	**8**
Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation, Frequency analysis, Filter design			
Unit - IV	**ADSP Processors**	Periods	**9**
Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.			
Unit – V	**TI's Advanced Processors**	Periods	**10**
Study of TI's advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP's Blackfin and Sigma DSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors			
		Total Periods	**45**
Text Books			
1.	B. Venkataramani and M. Bhaskar, Digital Signal Processors – Architecture, Programming and Applications– McGraw Hill Education, II Edition,2017.		
2.	Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi,2003.		
References			
1.	RulphChassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).		
2.	User guides Texas Instruments, Analog Devices and NXP.		
E-Resources			
1.	https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DIGITAL%20SIGNAL%20PROCESSING.pdf		
2.	https://www.studocu.com/in/document/pes-university/digital-signal-processing/ece-vii-dsp-algorithms-architecture-part-a/30053438		
3.	http://meseec.ce.rit.edu/eecc722-fall2003/722-10-8-2003.pdf		

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

(Autonomous Institution, Affiliated to Anna University ,Chennai)

Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV28	**Software Defined Radio**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- To understand the signal processing algorithms, filter design methods, and signal processing techniques
- To provide the design engineers with the tools necessary for efficient implementation of digital transceivers
- To focus on the multirate systems arising in the communications, especially wireless and software defined radios
- To understand software radio design and implement Multirate DSP, RF front-ends, direct digital synthesis of modulated waveforms, A/D and D/A conversion

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Implement a resampling architecture for digital RF front end systems	K2
	CO2: Differentiate efficient filtering methods for baseband transceivers design.	K2
	CO3: Acquire knowledge of various cascade systems.	K4
	CO4: Make use of multirate systems for communication systems	K3
	CO5: Exploit software radio design techniques for wireless systems and sub-systems	K3
Pre-requisites	**-**	

CO / PO Mapping (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**	**PS O1**	**PS O 2**	**PS O 3**
CO 1	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
CO 2	3	3	2	2	-	-	-	-	-	-	-	2	3	2	-
CO 3	3	3	2	3	-	-	-	-	-	-	-	2	3	2	-
CO 4	3	3	2	3	-	-	-	-	-	-	-	2	3	2	-
CO 5	3	3	2	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

Content of the syllabus

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Unit – I	**Multirate Signal Processing**	Periods	**9**
Fundamentals of Multirate Signal Processing – Nyquist and Square root Nyquist Filter –Systems using resampling filter – Quadrature Mirror Filters (QMF) – Theory and Application – Wavelet for multirate signal processing.			
Unit – II	**Filter implementations for baseband transceivers**	Periods	**9**
Polyphase FIR filter – Resampling Filter – Half-band Filters – Dyadic filter – Arbitrary Sampling Rate Conversion -Recursive polyphase filter			
Unit – III	**Cascaded Systems**	Periods	**9**
Cascade Integrator Comb Filter (CIC) – Cascade and multiple stage filters – Analog to Digital and Digital to Analog converters for SDR.			
Unit – IV	**Multirate systems for carrier**	Periods	**9**
Application in communication systems – Conventional Digital down converters (DDC) – Aliasing DDC – Timing recovery in digital demodulation – Carrier recovery and phase recovery – Introduction to software-defined radio – Review of telecommunication concepts and systems			
Unit – V	**Digital filtering**	Periods	**9**
Analog and Digital Communication System – Front-end RF system – Link Budgets – noise – C/N and S/N ratios – Digital filtering – Signal recovery – Baseband and Band pass Sampling – Complete SDR systems – Future trends in SDR-RFNM: a next generation SDR.			
		Total Periods	**45**

Text Books	
1.	Fredric J Harris, “Multirate Signal Processing for Communication Systems”, Pearson Education, 2007(2004)
2.	BehrouzFarhang-Boroujeny, “Signal Processing Techniques for Software Radios”, Lulu Publishing House, II Edition,2010(2008).
3	Jeffrey H Reed, “Software Radio: A Modern Approach to Radio Engineering”, Prentice Hall PTR, 2002.
References	
1.	Vaidyanathan P P, “Multirate Systems and Filter Banks”, Prentice Hall Inc., 1993.
2.	N. J. Fliege, “Multirate Digital Signal Processing – Multirate Systems”, Filter Banks andWavelets, John Wiley, 1994.
3.	Tony J. Rouphael, “RF and Digital Signal Processing for Software-Defined Radio: A Multi-Standard Multi-Mode Approach”, Elsevier Inc., 2009.
4.	Walter Tuttlebee, “Software Defined Radio: Origins, Drivers and International Perspectives”, John Wiley and Sons Ltd, 2002.
E-Resources	
1.	https://www.amrita.edu/course/multirate-signal-processing-software-defined-radio/
2.	https://www.amrita.edu/course/software-defined-networking-and-security/
3.	https://onlinecourses.nptel.ac.in/noc22_ee78/preview

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV31	**Wireless Communication**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • To understand the basic wireless communication systems. • Comprehend the design of a wireless channel model. • To understand the multiple access techniques in wireless communication. • To acquire the knowledge about capacity of wireless channel. • Figure out the concepts of cellular techniques

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Describe the various standards used in Wireless communication	K2
	CO2: Capable of characterizing a wireless channel and evolve the channel modeling specifications.	K3
	CO3:. Classify different multiple techniques used in wireless communication	K4
	CO4: Analyze the channel capacity of wireless channel.	K2
	CO5:.Realize the fundamental concepts of cellular concepts	K4
Pre-requisites	Analog and Digital communication	

CO / PO Mapping (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					2		2			3		2
CO 2	3	3	2	2				2				2	3	2	
CO 3	3	3	2	2				2		2			3	2	
CO 4	3	2	2	2						2		2	3	3	
CO 5	3	2	2										3		

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**EVOLUTION OF WIRELESS COMMUNICATION AND TECHNOLOGIES**	Periods	**9**

Introduction to wireless communication systems - Mobile Technologies - GSM, 3G, 4G (LTE) and 5G technologies, Wireless LAN Technologies and WLL

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Unit – II	WIRELESS CHANNEL MODELING	Periods	9
Free space propagation model, Reflection- Diffraction – Scattering - Log-normal shadowing. Small-scale multipath propagation, Types of small scale fading, Rayleigh and Ricean distribution, Input /output model of the wireless channel - Time and frequency coherence - Statistical channel models.			
Unit – III	**MULTIPLE ACCESS SCHEMES AND DIVERSITY**	Periods	**9**
FDMA, TDMA, CDMA, SDMA and CSMA, OFDMA. Diversity Techniques – Frequency diversity, Time diversity, Code diversity, Antenna diversity –RAKE Receiver - SIMO, MISO, MIMO, MIMO-OFDM Technique			
Unit – IV	**CAPACITY OF WIRELESS CHANNELS**	Periods	**9**
AWGN channel capacity – capacity of flat fading channels , Frequency- selective fading channels, Multiuser capacity, Downlink channel capacity, Uplink channel capacity, Outage capacity			
Unit – V	**INTRODUCTION TO CELLULAR CONCEPTS**	Periods	**9**
Cellular concept- system design fundamentals Handoff Strategies- Interference and system capacity, Improving Coverage and Capacity			
		Total Periods	**45**

Text Books	
1.	Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2012.
2.	David Tse, Pramod Viswanath , "Fundamentals of Wireless Communication", Cambridge University Press, 2015.
References	
1.	Kamilo Feher, "Wireless Digital Communications, Modulation & Spread Spectrum Applications", PHI, 2015.
2.	William C. Y. Lee, "Mobile Communication Engineering", McGraw Hill, 2014.
3.	Theodore S. Rappaport , "Wireless Communications", Pearson Education, 2017.
4.	Andreas F. Molisch , "Wireless Communications", Wiley, 2011.
E-Resources	
1.	*http://ee.sharif.edu/~wireless.comm.net/references/Rappaport%20-%20Wireless%20Communications,Principles%20and%20Practice-ISBN%200130422320.pdf*
2.	https://easyengineering.net/wireless-communications-by-andreas-f-molisch/
3.	https://web.stanford.edu/~dntse/wireless_book.html

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV32	**Mobile Communication**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- To impart knowledge on various generations of Cellular communication and standards.
- Choose proper diversity methods depending on channel model
- Choose proper multiple accessing methods depending on channel model.
- Providing a basic understanding of the key technologies and enables of 5G
- Learning future generation Example: 6G and Millimeter Wave etc.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the cellular concept and characterize the propagation models.	K2
	CO2: Illustrate the effects of multipath propagation and the compensation by diversity and equalization.	K3
	CO3: Comprehend the multiple access techniques.	K2
	CO4: Interpret the characteristics of 4G/5G wireless networks.	K2
	CO5: Construct the nature of 6G wireless networks.	K2
Pre-requisites	**Analog and Digital Communication**	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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					2					3	2	
CO 2	3	3	2	2				2		2			3		2
CO 3	3	3	2	2									3	2	
CO 4	3	2	2	2				2		2			3		2
CO 5	3	2	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

Content of the syllabus

Unit – I	**CELLULAR CONCEPT AND PROPAGATION MODEL**	Periods	**9**

Frequency reuse–Channel assignment strategies, Handoff strategies, Interference and system capacity, Co-channel interference and system capacity- Free space propagation model- Terrestrial propagation: Reflection- Two ray ground model- Scattering model- Indoor propagation model – Outdoor propagation

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model – Durkins model.			
Unit – II	**CHANNEL MODEL, EQUALIZERS AND DIVERSITY TECHNIQUES**	Periods	**9**
Small-scale multipath propagation and measurements - Mobile multipath channel parameters - Types of small scale fading- Rayleigh and Rician channel model- Equalizers: Linear and nonlinear equalizers- Equalizer algorithms – Zero forcing- Least mean square- Selection diversity model - RAKE receiver.			
Unit – III	**MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATIONS**	Periods	**9**
FDMA-TDMA- Spread spectrum multiple access-Capacity of cellular CDMA – SDMA- WCDMA- Packet radio protocols- Capture effect in packet radio.			
Unit – IV	**4G & 5G WIRELESS NETWORKS**	Periods	**9**
Architecture of LTE - Evolution of LTE Technology to beyond 4G — 5G objectives and usage scenarios, 10 Pillars of 5G – 5G Architecture – 5G Internet - channel access method/air interface - Cognitive Radio Technology in 5G Wireless Communication.			
Unit – V	**FUTURE WIRELESS NETWORKS**	Periods	**9**
Mm Wave: Applications, radio wave propagation Physical layer design and algorithms mmWave MIMO challenges channel modeling channel estimation Beam forming. 6G Key Enablers: Wireless energy harvesting, machine learning, visible light communication, Intelligent reflecting surface (IRS), Extremely Large Aperture Massive MIMO,			
		Total Periods	**45**
Text Books			
1.	Theodore S. Rappaport , "Wireless Communications", Pearson Education, 2017.		
2.	R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies., John Willey & Sons, West Sussex, 2017.		
3.	Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology. 2020		
References			
1.	Christopher Cox, "An Introduction to LTE: LTE, LTE Advanced, SAE, VoLTE and 4G Mobile Communications", 2nd Edition, Wiley Publications, New Delhi, 2014.		
2.	Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", 1st Edition, CRC Press Taylor & Francis Group, USA, 2019.		
3.	Simon Haykin , Michael Moher, David Koilpillai, ―Modern Wireless Communications‖, First Edition, Pearson Education 2013		
E-Resources			
1.	https://web.uettaxila.edu.pk/CMS/SP2013/teMCTTms/tutorial%5CMobile-Communications-JochenSchiller.pdf		
2.	https://www.vssut.ac.in/lecture_notes/lecture1428730613.pdf		
3.	http://ee.sharif.edu/~wireless.comm.net/references/Rappaport%20-%20Wireless%20Communications,Principles%20and%20Practice-ISBN%200130422320.pdf		

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Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV33	**Optical Communication**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to
- Introduce the relevance of this course to the existing technology through Demonstrations, Case Studies, Simulations, Contributions of scientist, National/International policies with a futuristic vision along with socio-economic impact and issues.
- Interpret the principle of light propagation through optical fibers.
- Understand signal distortion mechanisms in the fiber.
- Introduce optical transmitters and receivers for fiber /free space links
- Introduce optical network concepts and components involved.

Course Outcomes

At the end of the course, the student should be able to,	Knowledge Level
CO1: Recognize and classify the structures of Optical fiber and types.	K2
CO2: Discuss the channel impairments like losses and dispersion.	K2
CO3: Design a fiber optic link transmitter and receiver module.	K2
CO4: Familiar with Design considerations of fiber optic systems.	K3
CO5: Illustrate the Trouble shooting of various stages in an optical communication link	K2

Pre-requisites: Analog and Digital Communication

CO / PO Mapping (3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	-	-	-	-	2	-	-	-	-	3	2	-
CO 2	3	3	2	2	-	-	-	2	-	2	-	-	3	-	2
CO 3	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
CO 4	3	2	2	2	-	-	-	2	-	2	-	-	3	-	2
CO 5	3	2	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

Content of the syllabus

Unit – I	**INTRODUCTION TO OPTICAL FIBERS**	Periods	**9**

Elements of an Optical Fiber Systems, Optical fiber modes and configuration, Ray theory transmission, Mode

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theory of optical propagation, Parameters, fiber materials, Photonic crystal fiber, fiber fabrication techniques, Passive optical components - Optical couplers, Filters, Isolators.			
Unit – II	**TRANSMISSION CHARACTERISTICS**	Periods	**9**
Introduction, Optical signal attenuation mechanisms in guided and unguided optical signal transmissions, Optical signal Dispersion – Group delay, material dispersion, waveguide dispersion, polarization mode dispersion, Intermodal dispersion, profile dispersion, Modified single mode fibers- Dispersion Shifted Fibers, Dispersion Flattened Fibers, Polarization , Principles of fiber non linearity.			
Unit – III	**OPTICAL TRANSMITTERS**	Periods	**9**
Materials for optical sources, Light-Emitting Diodes - Power and Efficiency, Structure, Characteristics Semiconductor Laser Diodes - Basic Principles and emission, Temperature effects, External quantum efficiency, Structures, longitudinal modes, Gain and index-guiding, power-current characteristics, Injection Laser Characteristics, Laser sources and Transmitters for free space communication.			
Unit – IV	**OPTICAL RECEIVERS**	Periods	**9**
Performance and requirements for optical detectors, Principles of optical detection, spectral responsivity, PIN Photo diode , APD, Receiver noises, Signal to Noise Ratio (SNR) and Bit Error Rate (BER), Receiver structure, Preamplifier types, Principles of coherent detection, Link power and rise time budget, relevance of power and rise time budget in practical link/network planning.			
Unit – V	**OPTICAL AMPLIFIERS AND NETWORKS**	Periods	**9**
Optical amplifiers: Erbium doped fiber amplifiers, Semiconductor optical amplifiers, Optical switches, Optical MEMS components - Networking Concepts: SONET optical networks.			
		Total Periods	**45**
Text Books			
1.	Gerd Keiser, "Optical Fiber Communications", Tata McGraw –Hill, New Delhi, 5th Edition, 2013.		
2.	John M. Senior, "Optical Fiber Communications - Principles and Practice", Pearson Education, 3rd impression, 2012.		
References			
1.	Gerd Keiser, " Optical communications Essentials", Tata Mc Graw Hill, New Delhi, Special Indian Edition ,2008.		
2.	Govind P. Agrawal, " Fiber-Optic Communication Systems", John Wiley & Sons, Third Edition 2012.		
3.	Rajiv Ramasamy & Kumar N. Sivarajan, "Optical Networks – A Practical Perspective", 3rd Edition, Morgan Kauffman , 2011.		
E-Resources			
1.	https://shijuinpallotti.files.wordpress.com/2019/07/optical-fiber-communications-principles-and-pr.pdf		
2.	http://gsundar.weebly.com/uploads/5/4/5/6/54560163/optical_fiber_communication_by_gerd_keiser.pdf		
3.	https://shijuinpallotti.files.wordpress.com/2019/07/optical-fiber-communications-principles-and-pr.pdf		

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Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Program me Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV34	**MIMO Communications**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Understand the basics of MIMO
- Analyze the capacity and information rates of MIMO channels
- Understand the beam forming techniques
- Analyze different Turbo codes and iterative decoding for MIMO systems.
- Choose MIMO systems for Frequency-Selective(FS) fading channels.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the basics of MIMO Techniques.	K2
	CO2: Analyze the capacity and information rates of MIMO channels.	K2
	CO3: Analyze the beam forming techniques.	K2
	CO4: Realize MIMO channel models and Iterative decoding.	K3
	CO5: Understand OFDM's transceiver architecture.	K2
Pre-requisites	Analog and Digital Communication	

CO / PO Mapping (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					2					3	2	
CO 2	3	2	2	2				2		2			3		2
CO 3	3	2	2	2									3	2	
CO 4	3	3	2	2				2		2			3		2
CO 5	3	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

Content of the syllabus

Unit – I	**FADING CHANNELS AND DIVERSITY TECHNIQUES**	Periods	**9**

Wireless channels, Error/Outage probability over fading channels, Diversity techniques, Channel coding - Time Diversity, Multiple antennas in wireless communications.

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Unit – II	**CAPACITY AND INFORMATION RATES OF MIMO CHANNELS**	Periods	**9**
Capacity and Information rates of noisy, AWGN and fading channels, Capacity of non-coherent MIMO channels, Constrained signaling for MIMO communications.			
Unit – III	**SPACE TIME BLOCK AND TRELLIS CODE**	Periods	**9**
Alamouti scheme, Orthogonal and Quasi- orthogonal space-time block codes, Linear dispersion codes, Generic space-time trellis codes, Basic space-time code design principles, Representation of space-time trellis codes for PSK constellation, Performance analysis for space-time trellis codes, Comparison of space-time block and trellis codes.			
Unit – IV	**CONCATENATED CODES AND ITERATIVE DECODING**	Periods	**9**
Development of concatenated codes, Concatenated codes for AWGN and MIMO channels, Turbo coded modulation for MIMO channels, Concatenated space-time block coding.			
Unit – V	**SPACE-TIME CODING FOR FREQUENCY SELECTIVE FADING CHANNELS**	Periods	**9**
MIMO frequency - Selective channels, Capacity and Information rates of MIMO FS fading channels, Space-time coding and Channel detection for MIMO FS channels, MIMO OFDM systems			
	Total Periods		**45**
Text Books			
1.	Tolga M. Duman and Ali Ghrayeb, “Coding for MIMO Communication Systems”, John Wiley & Sons, West Sussex, England, 2008.		
2.	A.B. Gershman and N.D. Sidiropoulus, “Space-Time Processing for MIMO Communications”, Wiley, Hoboken, NJ, USA, 2005.		
References			
1.	E.G. Larsson and P.Stoica, “Space-time block coding for Wireless communications”, Cambridge University Press, 2003.		
2.	M. Janakiraman, “Space-Time Codes and MIMO systems”, Artech House, 2004.		
3.	H. Jafarkhani, “Space-Time Coding: Theory & Practice”, Cambridge University Press, 2005.		
E-Resources			
1.	https://pcefet.com/common/library/books/29/5940_[Erik_G._Larsson,_Petre_Stoica]_Space-Time_Block_C(b-ok.org).pdf		
2.	http://acsp.ece.cornell.edu/papers/Sung2SadlerTong05book.pdf		
3.	https://www.ursi.org/proceedings/procGA05/pdf/C08.1(01584).pdf		

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

Programme	**B.E.**	Program me Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV35	**Satellite Communication**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Study basic principles and orbital concept in Satellite Communication
- Illustrate the process involved in space segment and satellite transmission methodologies.
- Understand the different satellite access techniques.
- Know about process available in Earth station and different networking scenarios.
- Study different applications of satellite communication.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Demonstrate the basic principle of satellite communication and understand the concepts used in a Satellite Communication system.	K3
	CO2: Enumerate the segment of satellite and analyze the parameters of uplink and downlink system	K3
	CO3: Classify and compare different access techniques in free space communication	K4
	CO4: Understand the aspects behind Satellite links and Earth Station and Gain knowledge about Earth station and understand the networking in satellite communication	K2
	CO5: Analyze the different applications of Satellite Communication and its considerations	K4
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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							2		2	3		2
CO 2	3	3	2	2			2					2	3		
CO 3	3	3	2	2						2		2	3	2	
CO 4	3	2	2	2	2		2					2		2	
CO 5	3	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

Content of the syllabus

Unit – I	**SATELLITE ORBITS**	Periods	**9**

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Kepler's Laws, orbital elements, orbital perturbations, station keeping,–apogee and perigee heights, inclined orbits. The geo stationary orbits- Look Angle Determination- Limits of visibility –eclipse-Sub satellite point – Sun transit outage-Launching orbits			
Unit – II	**SPACE SEGMENT AND SATELLITE LINK DESIGN**	Periods	**9**
Introduction- Power supply, Attitude and Orbit control, Thermal control and Propulsion, transponders, the antenna subsystems. Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, EIRP, Transmission Losses, link power budget equation, System noise, C/N calculation, inter modulation and interference, inter-satellite links.			
Unit – III	**SATELLITE ACCESS**	Periods	**9**
Introduction, single access, pre-assigned FDMA, demand assigned FDMA, spade system, FDMA downlink analysis, TDMA-basic equipment in TDMA system, pre-assigned and demand assigned TDMA, downlink analysis for digital transmission, comparison of uplink power requirements for FDMA and TDMA, satellite-switched TDMA.CDMA-DSS, code signal ,acquisition and tracking, spectrum spreading and dispreading, CDMA throughput.			
Unit – IV	**EARTH SEGMENT AND SATELLITE IN NETWORKS**	Periods	**9**
Earth Station- Introduction, TVRO, MATV, CATV, Transmit and Receive earth stations. Satellite in networks-introduction, bandwidth, asynchronous transfer mode, ATM over satellite, satellite links and TCP, Enhancing TCP over satellite channels using standard mechanism, request for comments, split TCP connections.			
Unit – V	**SATELLITE APPLICATIONS**	Periods	**9**
DBS-Introduction, orbital spacing, power rating and number of transponders, frequency an polarization, transponders capacity, bit rates for digital television, MPEG compression standards, forward error correction, the home indoor and outdoor unit, downlink analysis, HDTV, Video frequency bandwidth, Satellite mobile services, INTELSAT Series, INSAT, VSAT, Radarsat, GPS, Orbcomm ,polar orbiting satellites.			
		Total Periods	**45**
Text Books			
1.	Dennis Roddy, "Satellite Communication", McGraw Hill International, 4th Edition Reprint, 2013.		
2.	Timothy Pratt, Charles W. Bostian, "Satellite Communications", John Wiley & Sons, 2nd Edition, 2009.		
References			
1.	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 3rd Edition, 2007.		
2.	Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.		
3.	M. O. Kolawole, "Satellite Communication Engineering", Marcel Dekker, Inc. NY,2nd Edition ,2013.		
4.	M. Richharia, "Satellite Systems for Personal Applications", John Wiley, 2010.		
E-Resources			
1.	https://www.srecwarangal.ac.in/ecdownloads/IV_II%20satellite_communications_by_dennis_roddy4thedition.pdf		
2.	https://www.scribd.com/doc/105119756/Solutions-Manual-for-Satellite-Communications-Second-edition-Timothy-Pratt-Charles-Bostian-Jeremy-Allnutt		
3.	https://kanchiuniv.ac.in/coursematerials/SATELLITE_COMMUNICATION.pdf		
4.	http://sedighy.ir/wpcontent/uploads/2014/10/ebooksclub.org__Introduction_to_Satellite_Communication__Artech_House_Space_Applications_.pdf		

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Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV36	**Green Technology**	3	0	0	3	40	60	100

Course Objective

The main objectives of this course are to:

- Acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- Provide green engineering solutions to energy demand, reduced energy footprint.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1:To understand the principles of green engineering and technology	K3
	CO2:To learn about pollution using hazardous chemicals and solvents	K3
	CO3:To modify processes and products to make them green and safe.	K4
	CO4:To design processes and products using green technology	K4
	CO5:To understand advanced technology in green synthesis	K4
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	3									2			
CO 2	3	3	3	2			2					2			
CO 3	3	3	3	2								2			
CO 4	3	3	3	2	2		2					2			
CO 5	3	3	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

Content of the syllabus

Unit – I	**PRINCIPLES OF GREEN CHEMISTRY**	Periods	**9**

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Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics,application of greenmetrics analysis to synthetic plans.			
Unit – II	**POLLUTION TYPES**	Periods	**9**
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types ofwaste,chemical,physical and biochemical methods ofwaste minimization and recycling.			
Unit – III	**GREEN REAGENTSAND GREEN SYNTHESIS**	Periods	**9**
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water asareactionmedium,energy-efficientdesignofprocesses-photo,electroands on chemical methods, microwave-assisted reactions			
Unit – IV	**DESIGNINGGREEN PROCESSES**	Periods	**9**
Safe design, process intensification, in process monitoring. Safe product and process design –Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention			
Unit – V	**GREEN NANOTECHNOLOGY**	Periods	**9**
Nano materials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nano technology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology			
		Total Periods	**45**
Text Books			
1.	Green technology and design for the environment, SamirB.Billatos, NadiaA.Basaly, Taylor &Francis, Washington,DC,©1997		
2.	Green Chemistry–An introductory text-M. Lancaster, RSC, 2016.		
3.	Green chemistry metrics-Alexi Lapkin and david Constable (Eds),Wiley publications,2008		
References			
1.	Environmental chemistry, Stanley E Manahan,Taylor and Francis, 2017		

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2023**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV37	**ADVANCED RADIATING SYSTEMS**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To get the Fundamental knowledge about Antennas.
- Analysis and design of Antenna Arrays
- Analysis and design of Aperture Antennas
- Analysis and design of Microstrip Antennas
- To gain knowlrdge on Modern Antenns

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Get through knowledge on the Antenna fundamentals.	K2
	CO2: Analyze and design of Array antennas.	K2
	CO3: Analyze and design of varios types of aperture antennas.	K2
	CO4: Analyze and design of various types of Microstrip antennas	K2
	CO5: Acquire knowledge on Modern antennas	K2
Pre-requisites	-	

CO / PO Mapping (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	2	2	2						3	3	2	2
CO 2	3	3	3	2	2	2						2	3	2	3
CO 3	3	3	3	2	2	2						2	3	2	2
CO 4	3	3	3	2	2	2						2	2	2	2
CO 5	3	3	3	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

Content of the syllabus

Unit – I	**ANTENNA FUNDAMENTALS**	Periods	**9**

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Introduction –Types – Radiation Mechanism – Antenna parameters - Radiation integrals - Radiation from surface and line current distributions – dipole, monopole, loop antenna; Image; Induction ,reciprocity theorem, Balance to unbalance transformer.			
Unit – II	**ANTENNA ARRAYS**	Periods	**9**
Review Array basics, General structure of phased array, linear array theory, variation of gain as a function of pointing direction, effects of phase quantization, frequency scanned arrays, analog beam forming matrices-Active modules, digital beam forming, MEMS technology in phased arrays-Retrodirective and self phased arrays.			
Unit – III	**RADIATION FROM APERTURES**	Periods	**9**
Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Babinets principle, Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.			
Unit – IV	**MICROSTRIP ANTENNA**	Periods	**9**
Radiation Mechanism and Excitation techniques : Microstrip dipole; Patch, Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Reconfiguration Mechanisms..			
Unit – V	**MODERN ANTENNAS**	Periods	**9**
IFA – Vivaldi Antennas - UWB Antennas - Antennas in Medicine – Leaky Wave Antennas –Plasma Antennas – Wearable Antennas – RFID Antennas - Automotive antennas, Reconfigurable antennas - Meta materials			
		Total Periods	**45**

Text Books	
1.	Balanis.A,C ―Antenna Theory Analysis and Design, 3rd Edition, John Wiley and Sons, New York, 1982.
2.	S. Drabowitch, A. Papiernik, H.D.Griffiths, J.Encinas, B.L.Smith, ―Modern Antennas, 2nd Edition, Springer Publications, 2007.
References	
1.	Thomas Kaiser, Smart Antennas: State of the Art, Hindawi, 2005
2.	Frank B. Gross, ―Frontiers in Antennas, Mc Graw Hill, 2011
3.	Krauss.J.D, ―Antennas, II edition, John Wiley and sons, New York, 1997
E-Resources	
1.	https://www.antenna-theory.com/
2.	https://archive.nptel.ac.in/courses/108/101/108101092/
3.	https://nptel.ac.in/courses/117107035

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV38	**ROCKETRY AND SPACE MECHANICS**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To present the knowledge on the fundamental laws of space mechanics with particular emphasis on interplanetary trajectories
- To imparts knowledge on Satellite dynamics
- To provides the basics of Rocket motion
- To provides the basics of Rocket dynamics.
- To help students to gain knowledge on various control methods of rockets..

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: To knowledge on the fundamental laws of space mechanics with particular emphasis on interplanetary trajectories.	K2
	CO2: To calculate orbital parameters and perform conceptual trajectory designs for geocentric or interplanetary missions.	K2
	CO3: To familiarize themselves with trajectory calculations for planar motion of rockets.	K2
	CO4: To determine forces and moments acting on airframe of a missile	K2
	CO5: To acquire knowledge on the need for staging and stage separation dynamics of rocket	K2
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	2	2						3	3	2	2
CO 2	3	3	3	2	2	2						2	3	2	3
CO 3	3	3	3	2	2	2						2	3	2	2
CO 4	3	3	3	2	2	2						2	2	2	2
CO 5	3	3	3	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

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Content of the syllabus

Unit – I	**BASIC CONCEPTS OF SPACE MECHANICS**	Periods	**9**

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler's laws of planetary motion and proof of the laws – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points – Estimation of orbital and escape velocities..

Unit – II	**SATELLITE DYNAMICS**	Periods	**9**

Geosynchronous and geostationary satellites- factors determining life time of satellites – satellite perturbations – orbit transfer and examples –Hohmann orbits – calculation of orbit parameters– Determination of satellite rectangular coordinates from orbital elements.

Unit – III	**ROCKET MOTION**	Periods	**9**

Principle of operation of rocket motor – thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories – determinations of range and altitude – simple approximations to burnout velocity..

Unit – IV	**ROCKET DYNAMICS**	Periods	**9**

Classification of launch vehicles and missiles – Rocket systems – Airframe components – Forces and moments acting on a rocket – Propulsion, aerodynamics, gravity – inertial and non-inertial frames – coordinate transformation – Equations of motion for three-dimensional motion through atmosphere and vacuum – numerical problems.

Unit – V	**STAGING AND CONTROL OF ROCKET VEHICLES**	Periods	**9**

Need for multi staging of rocket vehicles – multistage vehicle optimization – stage separation dynamics and separation techniques- aerodynamic and jet control methods of rocket vehicles – SITVC.

Total Periods	**45**

Text Books

1.	Cornelisse,JW, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd., London, 1982.
2.	Parker,ER, "Materials for Missiles and Spacecraft", McGraw-Hill Book Co., Inc., 1982.

References

1.	Suresh. B N & Sivan. K, "Integrated Design for Space Transportation System", Springer India, 2015.
2.	Sutton,GP, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 8th Edition, 2010.
3.	Van de Kamp, "Elements of Astromechanics", Pitman Publishing Co., Ltd., London, 1980.
4.	Joseph Jimmerson, "The Rocket Files", Lulu.com, 2nd Ed., 2013

E-Resources

1.	https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-ae04/
2.	https://archive.nptel.ac.in/courses/101/101/101101079/

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV41	**Embedded System Design and Real Time Applications**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Introduce the Building Blocks of Embedded System.
- Educate in Various Embedded Development Strategies.
- Introduce peripheral modules Communication in processors, Input/output interfacing.
- Impart knowledge in various processor scheduling programmes.
- Introduce Basics of Real time operating system and example tutorials to discuss on one real-time operating system tool.

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Gain a comprehensive understanding of embedded systems, including their overview, applications, and relevance in various domains.	K2
CO2: Understand the key features and functional block diagram of the TIVA ARM Cortex M4 microcontroller.	K2
CO3: Develop the ability to interface various peripherals with microcontrollers and utilize them in real-world applications.	K3
CO4: Understand the concepts and principles of host and target machines in embedded systems, including their roles and communication protocols.	K2
CO5: Understand the fundamental concepts and principles of real-time operating systems and their role in embedded systems.	K2

Pre-requisites: Microcontrollers

CO / PO Mapping
(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**
CO1	3					3	2	2		2		1	2		
CO2	3	3			2							1	2	2	
CO3	3	3	2		2					3	1	1	3	3	
CO4	3	3				2	2	2		3		1	2	2	
CO5	3	3			3			2		3		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

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Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**
Embedded system overview and applications, features and architecture considerations-ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O, CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture, instruction set, instruction formats, and various addressing modes. Fixed point and floating point arithmetic operations.			
Unit - II	**BASIC EMBEDDED PROGRAMMING TECHNIQUES**	Periods	**9**
Introduction to TIVA ARM Cortex M4 – Key Features – Functional Block Diagram - Pin Configuration –I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on Tiva, Active vs Standby current consumption.			
Unit – III	**TIMERS, PWM and Mixed Signal Processing**	Periods	**9**
Timer, Basic Timer, Real Time Clock (RTC), Timing generation and measurements, Analog interfacing and data acquisition: ADC, Analog Comparators, DMA, Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).			
Unit - IV	**HARDWARE/SOFTWARE INTEGRATION:**	Periods	**9**
Host and Target Machines. In-System Programming (ISP)-In-Application Programming (IAP)-Getting Embedded Software into Target System: Programmers. Display, Keyboard, Relay, Stepper and DC Motor Interfacing.			
Unit – V	**REAL TIME OPERATING SYSTEMS**	Periods	**9**
Survey of Software Architectures, Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and Pipes, Timer functions, Events, Memory Management and Interrupt Routines in RTOS Environment. Study of embedded product design with real time concepts using RTOS.			
		Total Periods	**45**

Text Books

1.	Jonathan Valvano, "Embedded Systems: Real-Time Operating Systems for Arm Cortex-M Microcontrollers", 2017.
2.	David E Simon, "An Embedded Software Primer", Pearson Education Asia, New Delhi, 2009.

References

1.	Rajkamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill, New Delhi, 2008.
2.	Andrew Sloss & Dominic Symes & Chris Wright, "ARM System Developer's Guide, 1st Edition, Elsevier, Morgan Kaufmann Publishers, 2004.
3.	Lyla B Das, ―Embedded Systems-An Integrated Approach‖, Pearson, 2013
4.	TIVA Series ARM Cortex M Data Sheet.
5.	www.ti.com/tiva

E-Resources

1.	*https://learnengineering.in/introduction-to-arm-cortex-m-microcontrollers-by-jonathan-w-valvano/*
2.	https://go-pdf.online/david-simon-embedded-systems.pdf
3.	https://www.scribd.com/document/328586500/embedded-systems-by-rajkamal-2nd-pdf

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV42	**Sensor for Industrial Applications**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is
- To understand the concepts of sensors and calibration technique
- To learn the different types of motion sensors
- To demonstrate force, magnetic and heading sensors with its application to the learners
- To enhance students to understand the concept of optical, pressure and temperature sensor
- To select suitable sensor for industrial application

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Recognize the various calibration techniques and types of sensors	K2
	CO2: Describe the working principle and characteristics of force, magnetic, heading, pressure and temperature, smart and other sensors and transducers.	K2
	CO3: Determine the principles of Force, magnetic and Heading sensors	K3
	CO4: Analyze different optical and thermal sensors	K3
	CO5: Select suitable sensor for real time applications	K4

Pre-requisites -

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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**
CO1	3	1	1									1	3		
CO2	3		3									1			
CO3	2	2	3				1						2		
CO4	2	2	3				1					1	2		
CO5	2	2	3				1					1	3		

Course Assessment Methods

Direct
4. Continuous Assessment Test I, II & III 5. Assignment: Simulation using tool 6. End-Semester examinations
Indirect
2. Course - end survey

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Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**9**
Principles of Physical and Chemical Sensors –Classification of sensors-Static and dynamic characteristics-Sensor calibration techniques-Sensor output Signal types			
Unit - II	**MOTION, PROXIMITY AND RANGING SENSORS**	Periods	**9**
Motion Sensors–Potentiometers, Resolver, Encoders–Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).			
Unit – III	**FORCE, MAGNETIC AND HEADING SENSORS**	Periods	**9**
Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers			
Unit - IV	**OPTICAL, PRESSURE AND TEMPERATURE SENSOR**	Periods	**9**
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermo couple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.			
Unit – V	**APPLICATIONS OF SENSORS**	Periods	**9**
Applications and case studies of Sensors in Automobile Engineering, Aeronautics, Machine tools and Manufacturing processes.			
		Total Periods	**45**

Text Books	
1.	Patranabis D., " Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., second edition 2013(revised).
2.	G.K.Anantha Suresh "Micro and smart systems",Wiley Edition,2010.
3.	Ernest O. Doebelin, "Measurement systems Application and Design", International Student Edition, VI Edition, Tata McGraw-Hill Book Company, 2012.
References	
1.	Bradley D.A., and Dawson, Burd and Loader, "Mechatronics, Thomson Press India Ltd", 2004.
2.	Ian R Sinclair, ―Sensors and Transducers‖, Third Edition, Newnes publishers,2011.
3.	Robert B.Northrop, "Introduction to Instrumentation and Measurement" ,3rd Edition" ,CRC–Press–Taylor and Francis Group,2005
E-Resources	
1.	https://www.finoit.com/blog/top-15-sensor-types-used-iot/
2.	https://www.iaasiaonline.com/smart-sensors-for-industrial-applications-2/
3.	https://www.first-sensor.com/en/applications/industrial/

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV43	**ARM System Architecture**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Give the students a thorough exposure to ARM architecture and make the students to learn the ARM programming & Thumb programming models.
- Learn to design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware.
- Describe the architecture of a typical embedded RISC processor (e.g. ARM Cortex)

Course Outcomes

At the end of the course, the student should be able to,	Knowledge Level
CO1: Interpreting the organization, architecture, memory and operation of the ARM processors.	K2
CO2: Become aware of the Thumb mode operation of ARM.	K2
CO3: Analyze the architectural support for higher level language.	K3
CO4:Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.	K3
CO5: Analyze various types of coprocessors and suitable design model.	K3

Pre-requisites -

CO / PO Mapping (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										3	2	1
CO 2	3	3	2	2									3	2	1
CO 3	3	3	2	2									3	2	1
CO 4	3	2	2	2									3	2	2
CO 5	3	2	2	2	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

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

ARM Architecture: ARM Processor fundamentals, ARM Architecture, ARM Design Philosophy, Registers, PSR, Pipeline, Interrupts and Vector Table, ARM Processor Families.
Instruction Set: Data Processing Instructions, Branch, Load, Store Instructions, PSR Instructions, Conditional

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Instructions.			
Unit – II	**ARM PROGRAMMING MODEL**	Periods	**9**
Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Interrupts, Software Interrupt Instructions, Exception handling			
Unit – III	**ARM PROGRAMMING USING HIGH LEVEL LANGUAGE**	Periods	**9**
Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.			
Unit – IV	**MEMORY MANAGEMENT**	Periods	**9**
Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Content Switch.			
Unit – V	**ARM APPLICATION DEVELOPMENT AND ADVANCED ARM PROCESSORS**	Periods	**9**
Introduction to Output Devices, Sensors and Actuators and Interfacing with arduino Uno, serial port terminal application. **Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture			
		Total Periods	**45**

Text Books	
1.	Sloss, D.Symes & C.Wright, "ARM system Developer's guide-Designing and Optimizing System Software", Elsevier.2005.
2.	S. Furber, "ARM System Architecture", Addison-Wesley, 1996.
References	
1.	The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu, Elsevier 2015
2.	Jonathan W. Valvano – Brookes / Cole, "Embedded Microcomputer Systems, Real Time Interfacing", 2012, Thomas Learning.
3.	Recent literature in ARM System Architecture.
4.	Technical reference manual for ARM processor cores, including Cortex, ARM 11, ARM 9 & ARM 7 processor families.
5.	User guides and reference manuals for ARM software development and modelling tools. David Seal, ARM Architecture Reference Manual, Addison-Wesley.
E-Resources	
1.	https://doc.lagout.org/electronics/Game%20boy%20advance/ARM_BOOKS/ARM_System_Developers_Guide-Designing_and_Optimizing_System_Software.pdf
2.	https://documentation-service.arm.com
3.	https://archive.nptel.ac.in/courses/106/105/106105193/

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV44	**Cloud Technologies and its Applications**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to
- To define the fundamental ideas behind Cloud Computing.
- To classify the basic ideas and principles in cloud information system.
- To Relate cloud storage technologies and relevant distributed file systems.
- Able to understand the application of cloud technology.
- To understand the application and design of webservice.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Explain the core concepts of the cloud computing paradigm	K1
	CO2: Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost	K3
	CO3: Illustrate the fundamental concepts of Cloud Applications	K4
	CO4: Explain the Applications of cloud	K3
	CO5: Advancing towards a Cloud	K3
Pre-requisites	-	

CO / PO Mapping (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**
CO 1	2	1	1	1	-	1	1	-	2	1	3	1	2	3	2
CO 2	1	1	2	1	1	3	1	-	2	1	3	1	3	3	2
CO 3	2	2	1	1	-	3	1	1	2	1	3	1	3	3	3
CO 4	1	1	1	2	2	1	-	2	1	3	1	2	2	2	1
CO 5	2	1	1	1	1	3	1	-	2	1	3	1	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

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet

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Software Evolution – Server Virtualization - Web Services Deliver from the Cloud – Communication-as-a-Service – Infrastructure-as-a-Service – Monitoring-as-a-Service – Platform-as-a-Service – Software-as-a-Service – Building Cloud Network.			
Unit – II	**CLOUD INFORMATION SYSTEMS**	Periods	**9**
Federation in the Cloud - Presence in the Cloud - Privacy and its Relation to Cloud-Based Information Systems – Security in the Cloud - Common Standards in the Cloud – End-User Access to the Cloud Computing.			
Unit – III	**CLOUD INFRASTRUCTURE**	Periods	**9**
Introduction– Evolving IT infrastructure – Evolving Software Applications –Service Oriented Architecture – Interoperability Standards for Data Center Management - Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment.			
Unit – IV	**CLOUD APPLICATIONS**	Periods	**9**
Software Utility Application Architecture - Characteristics of a SaaS - Software Utility Applications - Cost Versus Value - Software Application Services Framework - Common Enablers – Conceptual view to Reality – Business Profits - Implementing Database Systems for Multitenant Architecture - Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App			
Unit – V	**FUTURE OF CLOUD**	Periods	**9**
Other Design Considerations - Design of a Web Services Metering Interface - Application Monitoring			
		Total Periods	**45**

Text Books	
1.	Sandeep Bhowmik, & quot; Cloud Computing ",Cambridge University Press; First edition,2017
2.	Cloud Computing: Concepts, Technology Architecture‟, Pearson Education India, 1st edition (1 January 2014).
3.	Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
References	
1.	Sanjiva Shankar Dubey ,‟ Cloud Computing and Beyond‟, Dreamtech Press 2edition,2019
2.	John W. Rittinghouse and james F. Ransome, “Cloud Computing Implementation, Management and Security”, CRC Press, Taylor Francis Group, Boca Raton London New York, 2010.
3.	George Reese, “Cloud Application Architectures”, O‟reilly Publications, 2009.
E-Resources	
1.	www.coltdatacentres.net/Cloud Technology.
2.	https://www.cloudbakers.com/blog/what-is-a-cloud-application
3.	www.zdnet.com.

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV45	**IOT Processors**	3	0	0	3	40	60	100

Course Objective

- Learn the architecture and features of ARM.
- Study the exception handling and interrupts in CORTEX M3
- Program the CORTEX M3
- Learn the architecture of STM 32L15XXX ARM CORTEX M3/M4 microcontroller
- Understand the concepts of System – On – Chip(SoC)

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Explain the architecture and features of ARM.	K2
	CO2: List the concepts of exception handling.	K2
	CO3: Write a program using ARM CORTEX M3/M4	K3
	CO4: Learn the architecture of STM32L15XXX ARM CORTEX M3/M4	K2
	CO5: Design an SoC for any application.	K3
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	3	2	2	2	-	-	-	-	-	3	3	3	3
CO 2	3	3	3	3	2	2	-	-	-	-	-	2	3	3	3
CO 3	3	3	3	3	2	2	-	-	-	-	-	2	2	2	2
CO 4	3	3	2	2	2	2	-	-	-	-	-	2	2	2	2
CO 5	3	3	2	2	2	1	-	-	-	-	-	3	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

Content of the syllabus

Unit – I	**OVERVIEW OF ARM AND CORTEX-M3**	Periods	**9**

ARM Architecture – Versions, Instruction Set Development, Thumb 2 and Instruction Set Architecture, Cortex M3 Basics: Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations,

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Reset Sequence , CORTEX M3 Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions, CORTEX M3 – Implementation Overview: Pipeline, Block Diagram. Bus Interfaces, I – Code Bus, D – Code Bus, System Bus- External PPB and DAP Bus.			
Unit – II	**CORTEX EXCEPTION HANDLING AND INTERRUPTS**	Periods	**9**
Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor Call and Pendable Service Call, NVIC: Nested Vector Interrupt Controller, Overview, Basic Interrupts, SYSTICK Time, Interrupt Behaviourm Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail – Chaining Interrupts, Late Arrivals and Interrupt Latency.			
Unit – III	**CORTEX M3/M4 PROGRAMMING**	Periods	**9**
Cortex M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS Using Assembly, Excepiton Programming Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation, Memory Protection Unit and other CORTEX M3 Features, MPU Registers, Setting up the MPU, Power Management, Multiprocessor Configuration.			
Unit – IV	**STM32L15XXX ARMCORTEX M3/M4 MICROCONTROLLER 6 AND DEBUGGING TOOLS**	Periods	**9**
STM32L15XXX ARM CORTEX M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control, STM32L15XXX Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART Development and Debugging Tools: Software and Hardware tools like Cross Assemblerm Compiler, Debugger, Simulator, In – Circuit Emulator (ICE), Logic Analyser.			
Unit – V	**INTRODUCTION TO SYSTEM – ON – CHIP**	Periods	**9**
System Architecture: An Overview, Components of the System Processors, Memories and Interconnects, Processor Architectures, Memory and Addressing, System Level Interconnection – An Approach for SOC Design – Chip basics – Cycle Time – Die Area – Power and Cost – Area, Power and Time Trade – Offs in Processor Design – Reliability and Configurability – SOC Design Approach – Application Studies – AES, 3D Graphics Processor. Image Compression and Video Compression.			
Total Periods			**45**
Text Books			
1.	Joseph Yiu, The Definitive Guide to the ARM CORTEX M3/M4, Second Edition, Elsevier, 2010.		
2.	Andrew N Sloss, Dominic Symes, Chris Wright, ARM System Developers Guide Designing and Optimising System Software, Elsevier, 2006		
3.	Michael J Flynn and Wayne Luk, Computer System Design, System On Chip, Wiley India 2011.		
References			
1.	Steve Furber, ARM System – on – Chip Architecture, 2nd Edition, Pearson, 2015.		
2.	CORTEX M Series ARM Reference Manual		
3.	CORTEX M3 Technical Reference Manual		
4.	STM32L152XX ARM CORTEX M3 Microcontroller Reference Manual 5/97		

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code		**103**	Regulation	**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV46	**IoT Enabled Systems Design**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Understand the basics of IoT. • Get knowledge about the various services provided by IoT. • Familiarize themselves with various communication techniques and networking. • Know the implementation of IoT with different tools. • Understand the various applications in IoT.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Articulate the main concepts, key technologies, elements of IoT ecosystem.	K2
	CO2: Identify the architecture, infrastructure models of middleware and protocols of IoT.	K2
	CO3: Analyze the networking and how the sensors are communicated in IoT.	K4
	CO4: Analyze and design different models for IoT implementation.	K4
	CO5: Identify and design the new models for market strategic interaction.	K2
Pre-requisites	-	

CO / PO Mapping (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		
CO 2	3		2	2	3								2	2	
CO 3	3	2	3	3									3	3	
CO 4	3	2	3					2					2	2	
CO 5	3	2	3	3	2	2	2	2				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

Content of the syllabus

Unit – I	**Fundamentals of IoT**	Periods	**9**

Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

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Unit – II	MIDDLEWARE AND PROTOCOLS OF IOT	Periods	9
IoT Ecosystem Overview – Horizontal Architecture Approach for IoT Systems – SOA based IoT Middleware - Middleware architecture of RFID,WSN,SCADA,M2M –Interoperability challenges of IoT-Protocols for RFID,WSN,SCADA,M2M- Zigbee, KNX, BACnet, MODBUS - Challenges Introduced by 5G in IoT Middleware (Technological Requirements of 5G Systems - Perspectives and a Middleware Approach Toward 5G (COMPaaS Middleware) – Resource management in IoT.			
Unit – III	**COMMUNICATION AND NETWORKING**	Periods	**9**
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT- Data aggregation and dissemination.			
Unit – IV	**IOT IMPLEMENTATION TOOLS**	Periods	**9**
Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python, Implementation of IoT with Raspberry Pi..			
Unit – V	**APPLICATIONS AND CASE STUDIES**	Periods	**9**
Home automations - Smart cities – Environment – Energy – Retail – Logistics – Agriculture –Industry - Health and life style – Case study.			
		Total Periods	**45**

Text Books	
1.	Vlasios Tsiatsis, Jan Höller, Catherine Mulligan "Internet of Things Technologies and Applications for a New Age of Intelligence", Elsevier Academic Press, Second Edition 2018.
2.	Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2015.
3.	Honbo Zhou, "Internet of Things in the cloud: A middleware perspective", CRC press, 2012.
References	
1.	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017
2.	Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, "Internet of Things (IoT) in 5G Mobile Technologies" Springer International Publishing Switzerland 2016.
3.	Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things" Springer-Verlag Berlin Heidelberg, 2011.
E-Resources	
1.	*http://docshare04.docshare.tips/files/23353/233530586.pdf*
2.	https://profile.iiita.ac.in/bibhas.ghoshal/teaching_iot.html
3.	https://beckassets.blob.core.windows.net/product/readingsample/8279126/9783642191565_excerpt_001.pdf

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV47	**Industrial IOT and Industry 4.0**	3	0	0	3	50	50	100

Course Objective

The main objective of the course is to

- Learn and understand the Importance of IoT in industrial applications
- Apply the IoT concepts in building solutions to Industrial problems
- To learn about the basics of IOT protocols
- To apply the concept of IOT in the real world scenario

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the elements of IoT to build a total control plane in an Industrial application	K2
	CO2: Realize the importance of Data Analytics in IoT.	K3
	CO3: Understand the concepts of Protocols.	K4
	CO4: Study various IoT platforms and Security	K3
	CO5: Understand the concepts of Design Thinking.	K3
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	1	-	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 2	1	1	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 3	1	-	-	2	2	1	-	-	-	2	3	1	1	1	1
CO 4	1	-	1	1	2	2	-	-	-	3	2	3	2	2	1
CO 5	1	-	-	2	2	1	-	-	-	2	3	1	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

Content of the syllabus

Unit – I	**INDUSTRIAL IoT**	Periods	**9**

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models,

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Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking			
Unit – II	**IIOT ANALYTICS**	Periods	**9**
Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop			
Unit – III	**PROTOCOLS AND CLOUD**	Periods	**9**
Needof protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, BACnet, BLE, Modbus, SPI, I2C, IIoT protocols –COAP, MQTT, 6LoWPAN, LWM2M, AMPQ IIoT cloud platforms: Overview of COTS cloud platforms, Predix, PTC Thing Worx, Microsoft Azure etc. Data analytics, cloud services, Business models: SaaS, PaaS, IaaS.			
Unit – IV	**IOT SECURITY**	Periods	**9**
Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT			
Unit – V	**CASE STUDY**	Periods	**9**
Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries			
		Total Periods	**45**

Text Books	
1.	"Industrial Internet of Things: Cyber manufacturing Systems" by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017
2.	Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress), 2017
References	
1.	Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.
2.	The Internet of Things: Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi,2ndEdition, Willy Publications 2017
E-Resources	
1.	https://download.e-bookshelf.de/download/0007/6832/86/L-G-0007683286-0014731014.pdf
2.	https://www.ifm.eng.cam.ac.uk/uploads/DIAL/industrial-internet-of-things-report.pdf

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV48	**IOT SECURITY AND TRUST**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Design and implement cryptography algorithms using C programs
- Solve network security problems in IoT devices
- Build security systems using elementary blocks in IoT devices
- Build Trustable cloud based IoT systems
- Solve IoT security problems using light weight cryptography

Course Outcomes

At the end of the course, the student should be able to,	Knowledge Level
CO1:understand the Fundamentals of encryption for cyber security.	K3
CO2:study the IoT security framework	K3
CO3:understand IoT Security & Models for Identity Management systems	K4
CO4:understand Trust establishment and security analysis	K4
CO5: Study the Security and Digital Identity in Cloud Computing Cyber Crimes	K3

Pre-requisites -

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	1	1	1	1	-	1	1	-	2	1	3	1	2	3	2
CO 2	1	1	2	1	1	3	1	-	2	1	3	1	3	3	2
CO 3	2	2	1	1	-	3	1	1	2	1	3	1	3	3	3
CO 4	1	1	1	2	2	1	-	2	1	3	1	2	2	2	1
CO 5	2	1	1	1	1	3	1	-	2	1	3	1	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

Content of the syllabus

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Unit – I	Fundamentals of IoT ecosystem	Periods	9
IoT security issues, how to design an IoT system, Hardware, software and network security related to IoT systems - Basics of cryptographic solutions to IoT systems – Applied Cryptography & Intrusion Detection, One Way Hash Function and Integrity, Encryption Algorithms and Confidentiality, Digital Signature and Authentication (DH, RSA, 2 class)			
Unit – II	**Security concepts in context to IoT devices**	Periods	**9**
Internet of Things Security, Security and Privacy for IoT Case Study: Smart Home, Smart Grid Network, Modern Vehicle, Wearable Computing & BYOD, Mobile HealthCare.			
Unit – III	**IoT security threats and countermeasures**	Periods	**9**
System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyper jacking.			
Unit – IV	**Trust establishment**	Periods	**9**
Trust management lifecycle, Identity and Trust, Web of trust models. Establishment: cryptosystems – Mutual establishment phases – Comparison on security analysis.			
Unit – V	**Security and Digital Identity in Cloud Computing Cyber Crimes**	Periods	**9**
Cloud security , Digital identity management in cloud, Classical solutions, alternative solutions, Management of privacy and personal data in Cloud. Cyber Crimes and Laws – Hackers – Dealing with the rise tide of Cyber Crimes			
		Total Periods	**45**

Text Books	
1.	John R. Vacca, "Computer and Information Security Handbook", Elsevier, 2013. Parikshit Narendra Mahalle ,Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, 2015.
2.	William Stallings, "Cryptography and Network security: Principles and Practice", 5th Edition, 2014, Pearson Education, India.
3.	Brian Russell, Drew Van Duren, "Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem", 2nd Edition, 2018.
References	
1.	Christo Paar and Jan Pelzl, "Understanding Cryptography – A Textbook for Students and Practitioners", Springer, 2014.
2.	Alasdair Gilchrist, "IoT security Issues", Oreilly publications, 2017.
3.	Maryline Laurent, Samia Bouzefrane, "Digital Identity Management", Elsevier, 2015..
E-Resources	
1.	https://phoenixnap.com/blog/best-network-security-tools
2.	https://sucuri.net/guides/website-security/
3.	https://nptel.ac.in/courses/106/105/106105162/

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV51	**Mobile Adhoc Networks**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is

- To be aware of fundamental concepts of ad hoc network protocols and QOS
- To Understand the design issues of ad hoc network MAC protocols
- To familiarize with different MAC, routing and multicasting protocols of adhoc networks.
- To Study about design issues, challenges and goals in designing security protocols and QoS and architecture of sensor networks
- To be aware of Energy management schemes for ad hoc networks and its recent advances

Course Outcomes

At the end of the course, the student should be able to,	Knowledge Level
CO1: Compare the differences between cellular and ad hoc networks and the analyze the challenges at various layers and applications	K2
CO2: Summarize the protocols used at the MAC layer and scheduling mechanisms	K2
CO3: Compare and analyze types of routing protocols used for multicast routing and security protocols	K2
CO4: Examine the network security solution and routing mechanism	K2
CO5: Evaluate the energy management schemes and Quality of service solution in ad hoc networks and gain knowledge in recent advances in wireless network.	K2

Pre-requisites -

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	2	2						1	3	2	
CO 2	3	3	2	2	2	2						1	3		2
CO 3	3	3	2	2	2	2						1	3	2	
CO 4	3	3	2	2	2	2						1	3		2
CO 5	3	3	2	2	2	2						1	3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

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Unit – I	**INTRODUCTION**	Periods	**9**
Cellular and ad hoc wireless networks, Applications of ad hoc wireless networks. Issues in ad hoc wireless networks-medium access scheme, routing, multicasting, transport layer protocols, schemes, quality of service provisioning, self organization, addressing and service discovery, scalability.			
Unit – II	**MEDIUM ACCESS PROTOCOLS**	Periods	**9**
MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. Multichannel MAC protocol, CSMA MAC protocols and power control MAC protocols			
Unit – III	**ROUTING AND MULTICASTING PROTOCOLS**	Periods	**9**
Routing Protocols: Design issues, goals and classification. Table driven routing protocols, On demand routing protocols, Hybrid routing protocols, Hierarchical routing protocol, power routing protocols, issues and classification of multicast routing protocols, Tree based and mesh based multicast routing protocols. multicasting with QOS and application dependent multicast routing.			
Unit – IV	**SECURITY PROTOCOLS ,QOS AND WIRELE SENSOR NETWORK**	Periods	**9**
Network security requirement-Issues and challenges, network security attacks, key management, secure routing protocols. Issues and challenges in providing QOS, classification of QOS solutions and QOS frameworks-QOS models, INSIGNIA, INORA, SWAN, Proactive RTMAC. Sensor network architecture			
Unit – V	**ENERGY MANAGEMENT AND RECENT ADVANCES IN WIRELESS NETWORKS**	Periods	**9**
Energy management schemes-Battery management, transmission power management, system power management schemes. RECENT ADVANCES- Ultra wide band radio communication, Wireless fidelity systems, optical wireless networks, The multimode 802.11-IEEE 802.11a/b/g, The Meghadoot architecture.			
		Total Periods	**45**

Text Books	
1.	C.Siva Ram Murthy and B.S.Manoj, "Ad hoc Wireless Networks Architectures and Protocols",Pearson Education,2nd edition, 2015
2.	Charles E. Perkins, "Ad hoc Networking", Addison – Wesley, 2015
References	
1.	Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, "Mobile ad hoc Networking", Wiley-IEEE press, 2010.
2.	Mohammad Ilyas, "The Handbook of adhoc Wireless Networks", CRC press, 2002.
3.	T.Camp, J. Boleng, and V. Davies, "A Survey of Mobility Models for Ad Hoc Network Research,Wireless Commun. and Mobile Comp.", Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.
E-Resources	
1.	https://www.pdfdrive.com/ad-hoc-wireless-networks-architectures-and-protocols-c-siva-ram-murthy-bs-manoj-d77724424.html
2.	https://doc.lagout.org/network/Mobile%20Ad%20Hoc%20Networking.pdf
3.	https://library.oapen.org/handle/20.500.12657/41721

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester				
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV52	**Wireless Sensor Networks**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Learn Sensor Network fundamentals.
- Understand the different routing protocols.
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Sensor networks
- Have an exposure to mote programming platforms and tools.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Know the basics of Ad hoc networks and Wireless Sensor Networks	K2
	CO2: Illustrate this knowledge to identify the suitable routing algorithm based on the network and user requirement.	K3
	CO3: Understand the transport layer and security issues possible in sensor networks.	K3
	CO4: Apply the knowledge to identify appropriate application of sensors and MAC layer protocols.	K4
	CO5: Be familiar with the OS used in Wireless Sensor Networks and build basic modules	K4

Pre-requisites -

CO / PO Mapping
(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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	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

Content of the syllabus

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Unit – I	INTRODUCTION	Periods	9
Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.			
Unit - II	**WSN NETWORKING CONCEPTS AND PROTOCOLS**	Periods	**9**
MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.			
Unit – III	**SENSOR NETWORK SECURITY**	Periods	**9**
Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.			
Unit - IV	**OVERVIEW OF WIRELES SENSOR NETWORKS**	Periods	**9**
Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- . Topology Control, Clustering, Time Synchronization			
Unit – V	**SENSOR NETWORK PLATFORMS AND TOOLS**	Periods	**9**
Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.			
		Total Periods	**45**

Text Books

1.	Holger Karl, Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Oct 2007.
2.	FeiHu, Xiaojun Cao , " Wireless Sensor Networks , Principles and Practice CRC Press ,2010

References

1.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "―Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2015.
2.	Ian Akyildiz ,Mehmet Can Vuran "Wireless Sensor Networks" John Wiley & Sons USA 2010.
3.	Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks: an information processing approach‖, Elsevier publication, 2004
4.	Waltenegus Dargie, Christian Poellabauer ,"Fundamentals of Wireless Sensor Networks: Theory and Practice '(Wiley)July 2010
5.	Charles E. Perkins, ―Ad Hoc Networking‖, Addison Wesley, 2000.

E-Resources

1.	*http://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf*
2.	http://feihu.eng.ua.edu/-%20Fei%20Hu%20-%20WSN%20Textbook.pdf
3.	http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02

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

Programme	**B.E.**	Programme Code	**103**	Regulation			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV53	**Cryptography and Cyber Security**	3	0	0	3	40	60	100

Course Objective

- Study the Cryptography Theories, Algorithms and Systems.
- Understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
  Implement machine learning techniques WEB Security & Os Security
- Learn the Security Testing For Web Applications

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities	K2
	CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms	K3
	CO3: Apply the different cryptographic operations of public key cryptography	K3
	CO4: apply the machine learning techniques WEB Security & Os Security	K3
	CO5: Write software/project implementations of learning algorithms applied to real-world.	K2
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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					2		2			3		
CO 2	3	3	2	2			2				2		3		
CO 3	3	3	2	2									3	2	
CO 4	3	2	2	2				2	2		2		3	2	
CO 5	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

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and

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mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.			
Unit – II	**SYMMETRIC CRYPTOGRAPHY**	Periods	**9**
MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS**:** SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.			
Unit – III	**PUBLIC KEY CRYPTOGRAPHY**		**9**
MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.			
Unit – IV	**WEB SECURITY & OS SECURITY**	Periods	**9**
Overview, various types of web application vulnerabilities, Reconnaissance, Authentication, Authorization (Fuzzing and Privilege Escalation), Session Management, Cross Site Scripting (XSS),Cross Site Request Forgery (CSRF), SQL Injection and Blind SQL Injection. Memory and Address protection – Access Control –file protection mechanisms –User authentication –models of security –Trusted OS design.			
Unit – V	**SECURITY TESTING FOR WEB APPLICATIONS**	Periods	**9**
Case study of Client server application for a basic cryptosystem- Buffer overflow attack- Packet Sniffing using Wireshark Tool to perform the traffic analysis attack- Password authentication. Performing attacks and testing with attack tools.			
Total Periods			**45**
Text Books			
1.	Atul Kahate, "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill Education Pvt.Ltd., New Delhi, 2017.		
2.	William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2017.		
References			
1.	Niels Ferguson, Bruce Schneier, Tadayoshi Kohno, "Cryptography Engineering- Design Principles and Practical Applications", Wiley Publishing, Inc, Indiana, 2010.		
2.	Niels Ferguson and Bruce Schneier, "Practical Cryptography", John Wiley and Sons, 2003.		
3.	BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.		
4.	Brian Sullivan, Vincent Liu, "Web Application security: A beginners guide, Tata McGraw Hill, 2012.		
5.	Charles P Fleeger, Shari Lawrence P Fleeger, "Security in Computing", Pearson Education, 2004.		
E-Resources			
1.	http://indexof.es/Cryptography/Cryptography%20and%20Network%20Security%20Principles%20and%20Practices,%204th%20Ed%20-%20William%20Stallings.pdf		
2.	https://bh.titichest.cyou/155.html		
3.	http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf		

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV54	**Communication Switching and Networks**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Understand the concepts of Frequency, Time division multiplexing, digital Hierarchy
- Analyze space switching, time switching and combination switching, example of a switch namely No.4 ESS Toll switch.
- Illustrate the need for network synchronization and study synchronization issues.
- To Study the concepts of ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.
- Understand the concepts of Traffic Characterization, Delay Systems, Exponential service Times and Constant Service Times.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Recall the different multiplexing technique.	K2
	CO2: Illustrate the concepts space switching, time switching and combination switching, example of a switch namely No.4 ESS Toll switch.	K2
	CO3: Understand Network Synchronization.	K2
	CO4: Summarize ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.	K3
	CO5: Analyze the Traffic Characterization	K4
Pre-requisites	-	

CO / PO Mapping (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					2					3	2	
CO 2	3	3	2	2				2		2			3		2
CO 3	3	3	2	2									3	2	
CO 4	3	2	2	2				2		2			3		2
CO 5	3	2	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

Content of the syllabus

Unit – I	**MULTIPLEXING**	Periods	**9**

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Transmission Systems, FDM, TDM, Digital Transmission and Multiplexing, SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path- Switched Ring, Bidirectional Line-Switched Ring.			
Unit – II	**DIGITAL SWITCHING**	Periods	**9**
Switching Functions, Space Division Switching, Time Division Switching, two-dimensional switches: STS Switching, TST Switching, No.4 ESS Toll Switch, System 75 Digital PBX, Digital Cross-Connect Systems, Digital Switching in an Analog Environment.			
UNIT – III	**NETWORK SYNCHRONIZATION**	Periods	**9**
Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization: Master-slave synchronization, U.S. Network Synchronization.			
Unit – IV	**DIGITAL SUBSCRIBER ACCESS**	Periods	**9**
ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital LoopCarrier,FiberintheLoop,HybridFiberCoaxSystems,VoicebandModems:PCMModems,Local Microwave Distribution Service			
Unit – V	**TRAFFIC ANALYSIS**	Periods	**9**
Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times.			
		Total Periods	**45**
Text Books			
1.	J. Bellamy, "Digital Telephony", John Wiley, 3rdEdition, 2011.		
2.	R.A.Thomson, "Telephone switching Systems", Artech House Publishers, 2000		
References			
1.	W. Stalling, "Data and Computer Communications", Prentice Hall, 10th edition, 2013.		
2.	T.N.Saadawi, M.H.Ammar, A.E.Hakeem, "Fundamentals of Telecommunication Networks", Wiley Interscience, 1994.		
E-Resources			
1.	https://emdaduits.files.wordpress.com/2011/12/digital-telephonythird-edition___john-c-bellamy.pdf		
2.	https://ccsuniversity.ac.in/bridge-library/pdf/EC_8th_Sem_Electronic%20Switching_P_Gnanasivam%20-%20Telecommunication%20Switching%20and%20Networks_2nd-Edition-2008.pdf		
3.	http://index-of.es/Varios-2/Fundamentals%20of%20Telecommunications.pdf		

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV55	**SOCIAL NETWORK SECURITY**	3	0	0	3	40	60	100

Course Objective	• To develop semantic web related simple applications • To explain Privacy and Security issues in Social Networking • To explain the data extraction and mining of social networks • To discuss the prediction of human behavior in social communities • To describe the Access Control, Privacy and Security management of social networks	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Develop semantic web related simple applications	K3
	CO2: Address Privacy and Security issues in Social Networking	K2
	CO3: Explain the data extraction and mining of social networks	K2
	CO4: Discuss the prediction of human behavior in social communities	K3
	CO5: Describe the applications of social networks	K4
Pre-requisites	**-**	

CO / PO Mapping (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**
CO 1	3	2	2	2	2	-	-	-	1	2	1	2	3	2	2
CO 2	3	2	2	2	2	-	-	-	1	2	1	2	3	2	2
CO 3	3	2	2	2	2	-	-	-	1	2	1	2	3	2	2
CO 4	3	2	2	2	2	-	-	-	1	2	1	2	3	2	2
CO 5	3	2	2	2	2	-	-	-	1	2	1	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

Content of the syllabus

Unit – I	**FUNDAMENTALS OF SOCIAL NETWORKING**	Periods	**9**

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

Unit – II	**SECURITYISSUES INSOCIAL NETWORKS**	Periods	**9**

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes

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and behaviors, Anonymity in a networked world			
Unit – III	**EXTRACTIONANDMININGINSOCIALNETWORKINGDATA**	Periods	**9**
Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy			
Unit – IV	**PREDICTINGHUMANBEHAVIORAND PRIVACYISSUES**	Periods	**10**
Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties			
Unit – V	**ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT**	Periods	**9**
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles- based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning			
		Total Periods	**45**

Text Books

1.	Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2.	BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer,2010.
3.	LearningNeo4j3.xSecondEditionByJérôme Baton, Rik VanBruggen, Packt publishing
4.	DavidEasley,JonKleinberg,Networks,Crowds,andMarkets:ReasoningaboutaHighlyConnectedWorld‖,FirstEdition,CambridgeUniversityPress,2010

REFERENCES:

1.	Easley D.KleinbergJ., Networks, Crowds, and Markets– Reasoning about a Highly Connected World, Cambridge University Press,2010
2.	Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.
3.	Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
4.	Guandong Xu, Yanchun Zhang and LinLi,―Web Mining and Social Networking–Techniques and applications ,First Edition,Springer,2011.
5.	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling‖, IGI Global Snippet, 2009.
6.	John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer,2009.

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV56	**Cyber Security**	3	0	0	3	40	60	100

Course Objective	• learn the Cryptography techniques • Illustrate the Security Program • Explicit to represent knowledge in Network Security • Implement machine learning techniques WEB Security & Os Security • Learn the Security Testing For Web Applications	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Apply the Cryptography techniques	K3
	CO2: understand the Security Program	K2
	CO3: understand they represent knowledge in Network Security	K2
	CO4: apply the machine learning techniques WEB Security & Os Security	K3
	CO5: Write software/project implementations of learning algorithms applied to real-world.	K4
Pre-requisites	-	

CO / PO Mapping (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				2			2			2		2
CO 2	3	3	2	2					2				3	2	
CO 3	3	3	2	2			2						3		2
CO 4	3	2	2	2						2			3	3	
CO 5	3	2	2					2					3		

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION & CRYPTOGRAPHY**	Periods	**9**

Security Goals, Attacks, Services and Mechanisms – Techniques – Understanding Threats. Basic encryption and decryption – Substitution, Transposition – AES- Public key cryptosystem: RSA cryptosystem –Data Integrity- Cryptography hash functions- Digital Signatures-Digital signature standard(DSS)- Authentication-Passwords- Biometrics-Interactive protocol.

Unit – II	**PROGRAM SECURITY**	Periods	**9**

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Key management – Diffie –Hellman Key exchange- Digital certificates. Secure Programs – Buffer overflows – Malware – viruses and other malicious code – Targeted Malicious-code –Defense Mechanism.			
Unit – III	**NETWORK SECURITY**	Periods	**9**
Security at application layer: email security – SMIME- Security at transport layer: SSL protocol. Security at network layer: firewalls – intrusion detection system – IPsec			
Unit – IV	**WEB SECURITY & OS SECURITY**	Periods	**10**
Overview, various types of web application vulnerabilities, Reconnaissance, Authentication, Authorization (Fuzzing and Privilege Escalation), Session Management, Cross Site Scripting (XSS),Cross Site Request Forgery (CSRF), SQL Injection and Blind SQL Injection. Memory and Address protection – Access Control – file protection mechanisms –User authentication –models of security –Trusted OS design.			
Unit – V	**SECURITY TESTING FOR WEB APPLICATIONS**	Periods	**9**
Case study of Client server application for a basic cryptosystem- Buffer overflow attack- Packet Sniffing using Wireshark Tool to perform the traffic analysis attack- Password authentication. Performing attacks and testing with attack tools.			
		Total Periods	**45**

Text Books	
1.	James Graham, Richard Howard and Ryan Olson, Cyber Security Essentials, CRC Press,USA, 2011
2.	Forouzan.B.A. and Mukhopadhyay.D, Cryptography and Network Security, Tata McGraw Hill, 2nd Edition, 2012
References	
1.	William Stallings, Cryptography and Network Security, Prentice Hall, 2017.
2.	Roberta Bragg, Mark Rhodes, Keith Strass Berg J, –Network Security- The Complete Reference‖, Tata McGraw Hill, 2006.
3.	Brian Sullivan, Vincent Liu, ―Web Application security: A beginners guide, Tata McGraw Hill, 2012.
4.	Charles P Fleeger, Shari Lawrence P Fleeger, ―Security in Computing‖, Pearson Education, 2004.
5.	Bruce Schneier,"Applied Cryptography: Protocols, Algorithms, and Source Code in C",Second Edition, Wiley, John & Sons, Incorporated, October 1995.
E-Resources	
1.	http://index-of.es/Hack/CyberSecuity.pdf
2.	http://www.nitjsr.ac.in/course_assignment/CS16CS4204CS4204%20Lecture%20Material.pdf
3.	http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV57	**Fiber Optic Sensors**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Familiarize about the fiber optic sensor technology.
- Study about the Polarization sensors and Fiber Grating sensors.
- Acquire knowledge about magnetic sensors and its faraday effect.
- Understand the operation of Chemical sensors and Biosensors.
- Apply the knowledge of optic sensors in Temperature analysis and also illustrate the operation of smart structures.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Interpret the technology of optical fibers and optical modulators.	K3
	CO2: Summarize the operation Polarization and Fiber Grating sensors.	K2
	CO3: Analyze the sensor multiplexing and the effect of magneto strictive Lorentz force.	K2
	CO4: Distinguish the operation of Optic Chemical and Biosensor.	K2
	CO5: Determine the measurement of current and voltage with its Chemical analysis.	K3
Pre-requisites	-	

CO / PO Mapping
(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	2	2	2						1	3	2	
CO 2	3	3	2	2	2	2						1	3		2
CO 3	3	3	2	2	2	2						1	3	2	
CO 4	3	3	2	2	2	2						1	3		2
CO 5	3	3	2	2	2	2						1	3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**SENSOR TECHNOLOGY**	Periods	**9**

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The Emergence of Fiber Optic Sensor Technology-Optical Fibers-Light Sources-Optical Detectors-Optical Modulators- Intensity-Based and Interferometric Sensors-Fabry perot, Mach Zender, Michelson and Sagnac.			
Unit – II	**GRATING SENSORS**	Periods	**9**
Multimode Grating and Polarization Sensors-Sensors Based on Relative Movement of Opposed Gratings-Grating Period Modulation-Sensors Based on the Photo elastic Effect-Retardation Plates- Fiber Grating Sensors.			
Unit – III	**DISTRIBUTED AND MAGNETIC SENSORS**	Periods	**9**
Fiber Optic Distributed and Magnetic Sensor-Distributed Sensing- Basic Principles of Sensor Multiplexing- Faraday effect sensors-Magneto strictive – Lorentz force sensors-Evanescent Field Absorption Sensors			
Unit – IV	**CHEMICAL AND BIOSENSOR**	Periods	**9**
Fiber Optic Chemical and Biosensor: Reagent Mediated sensor-Humidity sensor – pH sensor – Hydrogen sensor – CO_2 sensor – Ammonia sensor – Chloride sensor – Glucose sensor – Oxygen sensor – Surface Plasmonic Resonance based sensor			
Unit – V	**APPLICATIONS**	Periods	**9**
Industrial Applications of Fiber Optic Sensors : Temperature – Pressure – fluid level – flow – position – vibration – rotation measurements – Current -voltage measurement – Chemical analysis. Introduction to smart structures – Applications –skins.			
		Total Periods	**45**

Text Books	
1.	Eric Udd, William B. Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists", John Wiley & Sons 2011.
2.	Bhagavanadasa Gupta, Banshi Das Gupta, "Fiber Optic Sensors: Principles and Applications", New India Publishing 2006.
3.	David A. Krohn, "Fiber optic sensors: fundamentals and applications", ISA Publishing 2000.
4.	Francis T.S. Yu, Shizhuo Yin, Paul B. Ruffin, "Fiber Optic Sensors", CRC Press Publisher 2010.
References	
1.	B.Culshaw and J.Daykin, "Optic fiber Sensors Systems and Applications", Artech House 1989.
2.	KTV Grattan & BT Meggit, "Optical fiber sensor technology & Applications", Kluwer Academic 2000.
E-Resources	
1.	https://roctest.com/wp-content/uploads/2018/08/b05-1.pdf
2.	Fiber Optic Sensors: Principles and Applications - B.D.Gupta - Google Books

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV58	**Optical Networks**	3	0	0	3	40	60	100

Course Objective

- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use.
- Design of wavelength routing and virtual topology design.
- To enable the student to understand the differences in the design of data plane and the control plane
- Judge the concept of multiplexing and switched based network.
- Compose the concept of Access network functions and analyze the wavelength routing protocol.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Use the backbone infrastructure for our present and future communication needs	K1
	CO2: Design and analyze different wavelength routing networks use the various test beds.	K2
	CO3: Interpret different network management skills	K2
	CO4: Describe the advances and recent trends in the networking and switching approaches	K2
	CO5: Analyze the concept of different network architectures	K2
Pre-requisites	-	

CO / PO 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**
CO 1	3	2	2	1		2	2						2	1	
CO 2	3	2	2	1		2	2						2	1	
CO 3	3	2	2	1		2	2						2	1	
CO 4	3	2	2	1		2	2						2	1	
CO 5	3	2	2	1		2	2						2	1	

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**OPTICAL NETWORK ARCHITECTURE**	Periods	**9**

FDDI - SONET/SDH - Computer Interconnects – Metropolitan Area Networks – Layered Architecture. Broadcast and Select Networks: Topologies for Broadcast Networks – Media-Access Control (MAC)

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Protocols – Test beds.			
Unit – II	**WAVELENGTH ROUTING NETWORKS**	Periods	**9**
The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Architectural variations.Wavelength Routing Testbeds : ONE/Sea Me We-3 – AON – NTT Ring – MWTN – ONTC – Alcatel‟s-WDM Ring – MONET.			
Unit – III	**CONTROL AND MANAGEMENT**	Periods	**9**
Network Management functions – Configuration Management – Performance Management – Faulty Management – Optical Safety – Service Interface.			
Unit – IV	**PHOTONIC PACKET SWITCHING**	Periods	**9**
OTDM – Multiplexing and De-multiplexing – Synchronization – Broadcast OTDM Networks - Switch-Based Networks – OTDM Test beds.			
Unit – V	**ACCESS NETWORKS**	Periods	**9**
Network Architecture Overview –Enhanced HFC -Fiber to the Curb (FTTC) - PON Evolution- Today's Access Networks – Future Access Networks.			
Total Periods			**45**
Text Books			
1.	Rajiv Ramasami Kumar and Sivarajan N, "Optical Networks: A Practical Perspective", 4th Edition Harcourt Asia PTE Ltd Singapore, 2011.		
References			
1.	Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks", Prentice-Hall of India Private Limited, New Delhi, 2004.		
2.	Debasish Datta," Optical Networks", Oxford University Press, USA		
3.	Mrs. Pratibha D. Kulkarni Miss Sharvari D. Kulkarni," Optical Network and satellite communication"		
E-Resources			
1.	https://archive.nptel.ac.in/courses/108/106/108106167/		
2.	https://www.coursera.org/specializations/optical-engineering		

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

(Autonomous Institution, Affiliated to Anna University ,Chennai)

Elayampalayam, Tiruchengode – 637 205

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV61	**Artificial Intelligence and Machine Learning**	3	0	0	3	40	60	100

Course Objective

The main objectives of this course are to:

- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	Use appropriate search algorithms for problem solving	K3
	Apply reasoning under uncertainty	K3
	Build supervised learning models	K4
	Build ensembling and unsupervised models	K4
	Build deep learning neural network models	K4
Pre-requisites	-	

CO / PO Mapping (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	2	3	1	3	2	-	-	-	-	1	3	3	3
CO 2	3	2	2	3	1	3	2	-	-	-	-	1	3	3	3
CO 3	1	2	1	3	2	3	2	-	-	-	-	1	3	3	3
CO 4	1	2	3	1	3	3	2	-	-	-	-	1	3	3	3
CO 5	2	2	2	-	3	3	2	-	-	-	-	1	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

Content of the syllabus

Unit – I	**PROBLEMSOLVING**	Periods	**9**

Introduction to AI - AI Applications -Problem solving agents – search algorithms – uninformed search strategies–

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Heuristic search strategies–Local search and optimization problems–adversarial search– constraint satisfaction problems(CSP)			
Unit – II	**PROBABILISTIC REASONING**	Periods	**9**
Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning –Bayesian networks –exact inference in BN–approximate inference in BN– causal networks.			
Unit – III	**SUPERVISED LEARNING**	Periods	**9**
Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model –Naïve Bayes, Maximum margin classifier–Support vector machine ,Decision Tree, Random forests			
Unit – IV	**ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**	Periods	**9**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization			
Unit – V	**NEURAL NETWORKS**	Periods	**9**
Perceptron-Multilayer perceptron, activation functions, network training–gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyper parameter tuning, batch normalization, regularization,			
		Total Periods	**45**

Text Books	
1.	Stuart Russell and Peter Norvig, "Artificial Intelligence–Modern Approach", Fourth Edition, Pearson Education, 2021.
2.	EthemAlpaydin,"IntroductiontoMachineLearning",MITPress,FourthEdition,2020
References	
1.	DanW.Patterson,"IntroductiontoAIandES",PearsonEducation,2007
2.	KevinNight,ElaineRich,andNairB.,"ArtificialIntelligence",McGrawHill,2008
3.	Patrick H.Winston,"ArtificialIntelligence",ThirdEdition, PearsonEducation, 2006
4.	Deepak Khemani, "Artificial Intelligence",Tata McGraw Hill Education,
5.	ChristopherM.Bishop,"PatternRecognitionandMachineLearning",Springer,2006
6.	TomMitchell,"MachineLearning",McGrawHill,3rdEdition,1997.
7.	CharuC.Aggarwal,"DataClassificationAlgorithmsandApplications",CRCPress,2014
8.	Mehryar Mohri, Afshin Rostamizadeh,AmeetTalwalkar,"Foundations of Machine Learning", MIT Press,2012.
9.	IanGood fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV62	**Deep Learning**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Apply the idea of artificial neural networks and their architecture. • Illustrate techniques used for training artificial neural networks. • Enable design of an artificial neural network for classification. • Intend and exploitation of deep learning models for machine learning problems. • Implementations of learning algorithms applied to real-world.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Understand the mathematics behind functioning of artificial neural networks.	K2
	CO2: Analyze the given dataset for designing a neural network based solution.	K3
	CO3: Carry out design and implementation of deep learning models for signal/image processing applications.	K4
	CO4: Design and deploy simple Tensor Flow-based deep learning solutions to classification problems	K3
	CO5: Writing software/project implementations of learning algorithms.	K3
Pre-requisites	-	

CO / PO Mapping (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**
CO1	3	3													
CO2		3	2											2	
CO3		2	3	2									3	3	
CO4	2	2	2	2				2					3	2	
CO5	3	2	2									2	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

Content of the syllabus

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Unit – I	INTRODUCTION	Periods	9
Artificial Neural Networks - The Neuron-Expressing Linear Perceptrons as Neurons - Feed-Forward Neural Networks - Linear Neurons and Their Limitations - Sigmoid, Tanh, and ReLU Neurons - Softmax Output Layers - Training Feed-Forward Neural Networks.-Gradient Descent			
Unit - II	**DESIGNING OF NEURAL NETWORK**	Periods	**9**
Delta Rule and Learning Rates - Gradient Descent with Sigmoidal Neurons - The Back propagation Algorithm- Stochastic and Mini batch Gradient Descent - Test Sets - Validation Sets - and Over fitting- Preventing Over fitting in Deep Neural Networks - Implementing Neural Networks in Tensor Flow.			
Unit – III	**ARCHITECTURE OF NETWORK**	Periods	**9**
Local Minima in the Error Surfaces of Deep Networks- Model Identifiability - Spurious Local Minima in Deep Networks - Flat Regions in the Error Surface - Momentum-Based Optimization - Learning Rate Adaptation - Convolutional Neural Networks (CNN)- Architecture- Accelerating Training with Batch Normalization - Building a Convolutional Network using Tensor Flow			
Unit - IV	**ENCODER MODEL IN NEURAL NETWORKS**	Periods	**9**
Visualizing Learning in Convolutional Networks-Embedding and Representation Learning: Autoencoder Architecture-Implementing an Auto encoder in TensorFlow - Denoising- Sparsity in Auto encoders. Models for Sequence Analysis - Recurrent Neural Networks - Vanishing Gradient.			
Unit – V	**APPLICATION**	Periods	**9**
Long Short-Term Memory (LSTM) Unit s- TensorFlow Primitives for RNN Models -Augmenting Recurrent Networks with Attention. Deep Learning Automated ECG Noise Detection and Classification, ML in Network for routing, traffic prediction and classification, Application of ML in Cognitive Radio Network (CRN).			
		Total Periods	**45**

Text Books	
1.	Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly, 2017.
2.	Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.
References	
1.	Aurélien Géron, “Hands-On Machine Learning with Scikit- Learn and TensorFlow”, O’Reilly, 2017. Nikhil Ketkar, “Deep Learning with Python: A Hands-on Introduction”, Apress, 2017.
2.	Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.
3.	Palash Goyal, Sumit Pandey & Karan Jain, "Deep Learning for Natural Language Processing: Creating Neural Networks withpython", 1st Edition, Apress Media, New York, 2018.
4.	K. P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
5.	C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
E-Resources	
1.	*https://www.cin.ufpe.br/~tfl2/artificial-intelligence-modern-approach.9780131038059.25368.pdf*
2.	http://dwa-bis.xpl.io/cgi-bin/pdf.php?article=artificial%20intelligence%20third%20edition%20elaine%20rich%20pdf&code=ff289aa336a33fec5fc4e5f50940e98b
3.	http://users.isr.ist.utl.pt/~wurmd/Livros/school/Bishop%20-%20Pattern%20Recognition%20And%20Machine%20Learning%20-%20Springer%20%202006.pdf

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV63	**Neural Networks and its Applications**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Understand the concepts of Neural Networks, Modeling of Brain, applicable algorithms, and related applications.
- Analyze the algorithms for implementing simple artificial neural networks and their applications.
- Understand the Adaptive Linear Combiner principles
- Learn various Propagation Network schemes.
- Select different Architectures of Neural Network & Its Applications.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Analyze the relation between Real Brains and simple Artificial Neural Network models.	K2
CO2: Analyze and understand back propagation and associative memory.	K2
CO3: Describe the main factors involved in achieving good learning and generalization performance in Neural Network systems.	K2
CO4: Identify the main implementation issues for common Neural Network systems.	K3
CO5: Evaluate the practical considerations in applying Neural Networks to real classification and regression problems.	K3

Pre-requisites -

CO / PO Mapping
(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**
CO1	3	3	2					2					3	2	
CO2	3	3	2	2				2		2			3		2
CO3	3	3	2	2									3	2	
CO4	3	2	2	2				2		2			3		2
CO5	3	2	2							2			3	2	

Course Assessment Methods

Direct

4. Continuous Assessment Test I, II & III
5. Assignment: Simulation using tool
6. End-Semester examinations

Indirect

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2. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION AND SIMPLE NEURALETWORK**	Periods	**9**
Elementary Neurophysiology and Biological Neural Network-Artificial Neural Network (ANN) – Architecture, Biases and Thresholds, Hebb net, Perceptron, Adaline and Madaline.			
Unit-II	**BACK PROPOGATION AND ASSOCIATIVE MEMORY**	Periods	**9**
Back propagation Network- generalized Delta rule, Bidirectional Associative Memory, Hopefield Network-Applications			
Unit – III	**NEURAL NETWORKS BASED ON COMPETITION**	Periods	**9**
Kohonen Self organising Map, Learning Vector Quantisation, Counter propagation Network-Applications			
Unit - IV	**UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS**	Periods	**9**
Patterns and Features, training and learning in pattern recognition, Discriminant functions, Different types of pattern recognition. Unsupervised learning- hierarchical clustering, partitional clustering. Neural pattern recognition approach – perceptron model-Applications.			
Unit – V	**SUPERVISED LEARNING USING PARAMETRIC AND NON PARAMETRICAPPROACH**	Periods	**9**
Bayesian classifier, Non Parametric Density Estimation, Histograms, kernels, window estimators, k-nearest neighbor classifier, estimation of error rates-Applications.			
		Total Periods	**45**

Text Books

1.	Hagan, Demuth and Beale, ―Neural Network Design‖, Vikas Publishing House Pvt.Ltd., New Delhi, 2009.
2.	Freeman J.A., and Skapura B.M, ― Neural Networks, Algorithms, Applications and Programming Techniques‖, Addison – Wesley, 2004.

References

1.	Robert Schalkoff, ―Pattern Recognition, Statistical, Structural and Neural Approaches‖,John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2005.
2.	Laurene Fausett ,‖ Fundamentals of Neural Networks – Architectures, Algorithms and Applications‖, Prentice Hall, 1994.
3.	Duda R.O, Hart P.G, ―Pattern classification and scene analysis‖, Wiley Edition, 2013.
4.	Earl Gose, Richard Johnson baugh, Steve Jost, ―Pattern Recognition and Image Analysis‖,Prentice Hall of India Pvt. Ltd., New Delhi, Reprint, 2017.

E-Resources

1.	https://hagan.okstate.edu/NNDesign.pdf
2.	https://www.wiley.com/en-sg/exportProduct/pdf/9780471529743
3.	https://e.pdfpremiumfree.com/download/pattern_recognition_statistical_structural_and_neural_approaches/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV64	**Soft Computing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Study about FUZZY set theory, reasoning, if –then rules and modeling.
- Understand descent methods, optimization and related algorithms.
- Know the issues and acquisition of reasoning.
- Gain the knowledge inference system and adaptive network.
- Learn fuel efficiency prediction, Spectrum and character recognition.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Understand the basics of FUZZY set theory reasoning and decision making tools.	K2
	CO2: Acquire knowledge about descent methods, optimization and related algorithms.	K3
	CO3: Understand the Artificial intelligence, issues and acquisition of reasoning.	K2
	CO4: Analyze the knowledge of Neuro FUZZY modeling inference system and adaptive network.	K4
	CO5: Calculate the Automobile fuel efficiency prediction and character recognition	K4

Pre-requisites: A strong mathematical background, Programming skill in C, C++, Proficiency with algorithm

CO / PO Mapping (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					2		2			3	2	
CO 2	3	3	2	2							2		3		2
CO 3	3	3	2	2				2		2			3		
CO 4	3	2	2	2				2					3	2	
CO 5	3	2	2							2			3		

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

Content of the syllabus

Unit – I	**FUZZY SET THEORY**	Periods	**9**

Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-

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theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models,TsukamotoFuzzyModels,InputSpace Partitioning and Fuzzy Modeling.			
Unit - II	**OPTIMIZATION**	Periods	**9**
Derivative-based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, Random Search, Downhill Simplex Search.			
Unit – III	**ARTIFICIAL INTELLIGENCE**	Periods	**9**
Introduction, Knowledge Representation – Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty, Basic knowledge Representation Issues Knowledge acquisition – Heuristic Search: Techniques for Heuristic search Heuristic Classification.			
Unit - IV	**NEURO FUZZY MODELING**	Periods	**9**
Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN, Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Network, Neuro Fuzzy Spectrum.			
Unit – V	**APPLICATIONS OF COMPUTATIONAL INTELLIGENCE**	Periods	**9**
Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.			
		Total Periods	**45**

Text Books	
1.	S.R. Jang, C. T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education ,2012.
2.	N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2011.
References	
1.	Elaine Rich & Kevin Knight, "Artificial Intelligence, Second Edition", Tata Mcgraw Hill Publishing Comp., New Delhi,2006
2.	Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 2011.
3.	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI, 2003.
4.	R.Eberhart, P. Simpson and R. Dobbins, "Computational Intelligence - PC Tools", AP, Professional, Boston, 1996.
5.	Dr.S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India, 2007.
E-Resources	
1.	*http://www.soukalfi.edu.sk/01_NeuroFuzzyApproach.pdf*
2.	https://www.worldcat.org/title/artificial-intelligence-and-intelligent-systems/oclc/60836856
3.	http://iauctb.ac.ir/Files/%D9%88%D8%A8%20%D8%B3%D8%A7%DB%8C%D8%AA%20%D8%A7%D8%B3%D8%A7%D8%AA%DB%8C%D8%AF/fuzzy%20logic%20with%20engineering%20application-3rdEdition.pdf

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV65	**Computer Vision**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to
Know the major concepts of fundamentals of image
Understand the preprocessing and post processing techniques.
Understand the machine learning concepts and algorithms.

Course Outcomes

At the end of the course, the student should be able to,	Knowledge Level
CO1: Understand the major concepts and techniques in computer vision and image processing.	K2
CO2: Demonstrate computer vision and image processing knowledge by designing and implementing algorithms to solve practical problem.	K3
CO3: Gain knowledge in segmenting the image and perform Patten analysis.	K4
CO4: understand the concepts of machine learning	K3
CO5: gain knowledge on machine learning algorithms	K3

Pre-requisites: Basic knowledge on image and pixels

CO / PO 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**
CO 1	3	3	2										2	1	
CO 2	3	3	2										2	1	
CO 3	3	3	2										2	1	
CO 4	3	3	2										2	1	
CO 5	3	3	2										2	1	

CO/PSO Mapping

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**IMAGE PROCESSING FOUNDATIONS**	Periods	**9**

Image processing techniques - classical filtering operations - thresholding techniques - edge detection techniques - corner and interest point detection - mathematical morphology - texture.

Unit – II	**IMAGE FORMATION AND PROCESSING**	Periods	**9**

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Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine and Projective. Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.			
Unit – III	**FEATURE EXTRACTION**	Periods	**9**
Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT			
Unit – IV	**IMAGE SEGMENTATION**	Periods	**9**
Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.			
Unit – V	**PATTERN ANALYSIS**	Periods	**9**
Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.			
		Total Periods	**45**

Text Books	
1.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
References	
1.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2.	Christopher Bishop ,"pattern Recognition and Machine learning" springer,2007
3.	K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990
4.	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992
E-Resources	
1.	https://www.academia.edu/1071085/SIFT_features_tracking_for_video_stabilization
2.	https://www.academia.edu/1071085/SIFT_features_tracking_for_video_stabilization
3.	http://users.isr.ist.utl.pt/~wurmd/Livros/school/Bishop%20-%20Pattern%20Recognition%20And%20Machine%20Learning%20-%20Springer%20%202006.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV66	**AUGMENTED REALITY/ VIRTUAL REALITY**	3	0	0	3	40	60	100

Course Objective	• To impart the fundamental aspects and principles of AR/VR technologies • To know the internals of the hardware and software components involved in the development of AR/VR enabled applications • To learn about the graphical processing units and their architectures • To gain knowledge about AR/VR application development. • To know the technologies involved in the development of AR/VR based applications	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the basic concepts of AR and VR	K3
	CO2: Understand the tools and technologies related to AR/VR	K2
	CO3: Know the working principle of AR/VR related Sensor devices	K2
	CO4: Design of various models using modeling techniques	K3
	CO5: Develop AR/VR applications in different domains	K4
Pre-requisites	**-**	

CO / PO Mapping (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	2	-	3	-	-	-	2	2	1	2	2	1	2
CO 2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
CO 3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
CO 4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
CO 5	3	3	3	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

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

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Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories andHybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices –3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human VisualSystem – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human AuditorySystem**.**			
Unit – II	**VR MODELING**	Periods	**9**
Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.			
Unit – III	**VR PROGRAMMING**	Periods	**9**
VR Programming – Toolkits and Scene Graphs – World Tool Kit – Java 3D – Comparison of World Tool Kit and Java 3D			
Unit – IV	**APPLICATIONS**	Periods	**10**
Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR andSociety-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.			
Unit – V	**AUGMENTED REALITY**	Periods	**9**
Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices			
		Total Periods	**45**

Text Books

1.	Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018
2.	Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016
3.	John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
4.	William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV67	**Optimization Techniques**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Acquaint and familiarize with different types of optimization techniques,
- Interpret optimization problems,
- Implement computational techniques,
- Abstract mathematical results and proofs

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Infer the concepts of Evolutionary Computation	K2
	CO2: Solve an optimization problem with GA	K3
	CO3: Apply the advanced GA operators for Machine learning, Image Processing	K3
	CO4: Apply the concepts of PSO in optimization problems	K3
	CO5: Apply the concepts of ACO and cuckoo search in engineering applications	K4
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	2	2							1	3	2	
CO 2	3	3	2	2	2							1	3		2
CO 3	3	3	2	2	2							1	3	2	
CO 4	3	3	2	2	2							1	3		2
CO 5	3	3	2	2	2							1	3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**Introduction**	Periods	**9**

Features of Evolutionary Computation -Advantages of Evolutionary Computation - Applications of Evolutionary Computation.

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Unit – II	Genetic Algorithms:	Periods	9
Introduction-Biological background- Conventional Optimizationand Search Techniques.-Advantages and Limitations of Genetic Algorithm-Terminologies and Operators of GA			
Unit – III	**Advanced GA**	Periods	**9**
Advanced Operators and Techniques in Genetic Algorithm-Classification of Genetic Algorithm-Application of GA in Machine learning, Image Processing			
Unit – IV	**Particle Swarm Optimization**	Periods	**10**
PSO Algorithm - Accelerated PSO – Implementation - Convergence Analysis - Binary PSO –Applications			
Unit – V	**Ant Colony Optimization and Cuckoo Search**	Periods	**9**
ACO algorithm – Characteristics- -Convergence analysis - Implementation –Applications. CuckooSearch : Cuckoo Life Style –– flowchart –Algorithm			
		Total Periods	**45**

Text Books	
1.	Sivanandam S.N. &Deepa S.N., "Introduction to Genetic Algorithms", 1st Edition, Springer,NewYork, 2013.
2.	OmidBozorg & Haddad, "Advanced Optimization by Nature-Inspired Algorithms", Springer,Singapore, 2018
References:	
1.	SrikantaPatnaik, Xin-She Yang & Kazumi Nakamatsu, "Nature-Inspired Computing and Optimization Theory and Applications", Springer, Switzerland, 2017.
E-Resources	
1.	http://ftp.demec.ufpr.br/CFD/bibliografia/an_introduction_to_genetic_algorithms_for_scientists_and_engineers_coley.pdf
2.	https://msulaiman.org/onewebmedia/Xin-She_Yang_Auth._Nature-Inspired_Optimization_Algorithms.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV68	**ETHICS AND AI**	3	0	0	3	40	60	100

Course Objective	• Study the morality and ethics in AI • Learn about the Ethical initiatives in the field of artificial intelligence • Study about AI standards and Regulations • Study about social and ethical issues of Robot Ethics • Study about AI and Ethics- challenges and opportunities

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Learn about morality and ethics in AI	K3
	CO2: Acquire the knowledge of real time application ethics, issues and its challe	K2
	CO3: Understand the ethical harms and ethical initiatives in AI	K2
	CO4: Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous andSemi-Autonomous Systems	K3
	CO5: Learn about the societal issues in AI with National and International Strategies on AI	K4
Pre-requisites	**-**	

CO / PO Mapping (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	3	1	-	-	-	1	2	1	1	3	1	1
CO 2	2	1	1	2	1	-	-	-	1	2	1	1	3	3	1
CO 3	2	3	1	1	3	-	-	-	2	1	1	2	3	2	2
CO 4	3	1	3	3	2	-	-	-	2	2	3	1	2	1	3
CO 5	3	1	1	3	3	-	-	-	2	3	3	3	1	3	3

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**9**

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Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust			
Unit – II	**ETHICAL INITIATIVES IN AI**	Periods	**9**
International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization			
Unit – III	**AI STANDARDS AND REGULATION**	Periods	**9**
Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems			
Unit – IV	**ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS**	Periods	**10**
Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - EthicalIssues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy			
Unit – V	**AI AND ETHICS- CHALLENGES AND OPPORTUNITIES**	Periods	**9**
Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.			
		Total Periods	**45**

Text Books

1.	y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2.	Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014

REFERENCES:

1.	Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2.	Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

E-Resources

1.	https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2.	https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities
3.	https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
4.	https://sci-hub.mksa.top/10.1159/000492428

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV71	**Pattern Recognition**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to
- Understand different supervised learning techniques
- Understand different unsupervised learning techniques.
- Obtain sound knowledge in the recent advancement on pattern recognition techniques
- Understand the feature extraction and selection techniques
- Understand the advanced neural network structures for pattern recognition

Course Outcome

At the end of the course, the student should be able to,	**Knowledge level**
CO1: Analyze the pattern recognition algorithms for classifications.	K3
CO2: Apply the unsupervised learning techniques for pattern classification	K4
CO3: Explain the concepts of structural pattern recognition	K2
CO4: Analyze the feature extraction and selection techniques	K3
CO5: Analyze the advanced neural network structures for pattern recognition	K4

Pre-requisites: Signal & Image Processing

CO / PO Mapping (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	2											
CO 3	3	3	3	3											
CO 4	3	3	3					2							
CO 5	3	3	2												

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

Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**PATTERN CLASSIFIER**	Periods	**8**

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm -Problems with Bayes approach - Pattern classification by distance functions – Minimum distance pattern classifier.

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Unit - II	UNSUPERVISED CLASSIFICATION	Periods	9
Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm - Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.			
Unit – III	**STRUCTURAL PATTERN RECOGNITION**	Periods	**9**
Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications.			
Unit - IV	**FEATURE EXTRACTION AND SELECTION**	Periods	**9**
Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.			
Unit – V	**RECENT ADVANCES**	Periods	**9**
Neural network structures for Pattern Recognition - Neural network based Pattern associators - Unsupervised learning in neural Pattern Recognition			
		Total Periods	**45**

Text Books	
1.	Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley &Sons Inc., New York, 2007
2.	Duda R.O., Hart.P.E., and Strok, Pattern Classification, second Edition Wiley, New York, 2008.
References	
1.	Richard O Duda, Peter E Hart and David G Stork, ―Pattern Classification‖, Wiley India, New Delhi. 2010,
2.	Narasimha Murty M and Susheela Devi V,‖ Pattern Recognition: An Algorithmic Approach‖, University Press, India. 2011.
3.	sergios Theodoridis and Konstantinos Koutroumbas,‖ Pattern Recognition‖, Elsevier, New Delhi.2011.
4.	Christopher M Bishop, ‖Pattern Recognition and Machine Learning‖, Springer, USA.2011.
5.	Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993
E-Resources	
1.	*https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470050118.ecse302*
2.	https://ecorise.instructure.com/eportfolios/8609/JCV4/Read_FullPDF_Pattern_Classification_R_O_Duda_Solution_Manual
3.	https://www.worldcat.org/title/pattern-classification/oclc/41347061/editions?lang=ko&editionsView=true

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV72	**Medical Electronics**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Study the methods of various recording bio potentials through existing technology and national/international policies.
- Gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- Understand the use of various assist devices used in the hospitals.
- Identify the working of different physiological assist devices and the need and technique of electrical safety in hospitals.
- Understand the working of units that helps to restore normal functioning equipment used for physical medicine and the various recently developed therapeutic techniques.

Course Outcome

At the end of the course, the student should be able to	**Knowledge level**
CO1: Able to Analyze the methods of various recording biopotentials	K4
CO2: Ability to comprehend and appreciate the significance and roles in the present contemporary world	K3
CO3: Can analyze working of Cardiac care units, heart rate, pressure rate and different physiological assist devices	K3
CO4: Illustrate the working and use of X-rays and imaging systems	K2
CO5: Realize the recent trends in medical instrumentations that helps to restore normal functioning	K2

Pre-requisites

-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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					2		2			3		2
CO 2	3	3	2	2				2				2	3	2	
CO 3	3	3	2	2				2		2			3	2	
CO 4	3	2	2	2						2		2	3	3	
CO 5	3	2	2										3		

Course Assessment Methods

Direct

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

Content of the syllabus

Unit – I	**ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING**	Periods	**9**
The origin of Bioelectric signals, recording electrodes, electrodes for ECG,EEG,EMG, Microelectrodes, basic recording system, preamplifiers and biomedical recorders for ECG,EEG & EMG.			
Unit - II	**PATIENT MONITORING SYSTEM**	Periods	**9**
Measurement of Heart rate-Measurement of pulse rate-Blood Pressure Measurement-colorimeter, Auto analyzer -Blood PH measurement-Blood cell counters-Measurement of Blood PCO_2-Blood pO_2 Measurement.			
Unit – III	**ASSIST DEVICES AND BIO-TELEMETRY**	Periods	**9**
Bio-Telemetry-Cardiac Output Measurements-Cardiac Pacemakers and DC Defibrillators-Telemedicine System-Heart lung machine.			
Unit - IV	**MODERN IMAGING SYYSTEM**	Periods	**9**
Visualization of X-rays-basic principles of MRI, diagnostic ultrasound, medical ultrasound, Thermal Imaging Systems.			
Unit – V	**RECENT TRENDS IN MEDICAL INSTRUMENTATION**	Periods	**9**
Patient Safety- Laser applications in Bio-medical field- Cryogenic application – Radiotherapy equipment.			
		Total Periods	**45**

Text Books

1.	Khandpur, R.S., "Handbook of Biomedical Instrumentation", Tata McGraw Hill Education (India) Private Limited, 3r^{d} Edition, 2016.
2.	Leislie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2nd Edition, 2015.

References

1.	John G.Webster, "Medical Instrumentation Application and Design" Wiley India, 4th Edition, 2015.
2.	Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 4th Edition, 2014.
3.	Digital Image Processing , S Jayaraman, S Esakkirajan T Veerakumar, Mc Graw-Hill, 2010.
4.	Digital Image Processing, K.William Pratt, John Wiley, 1997.
5.	Image Processing Theory, Algorithm and Architectures, M.A.Sid Ahmed,McGraw-Hill, 1995.

E-Resources

1.	http://fa.bme.sut.ac.ir/Downloads/AcademicStaff/3/Courses/4/Medical%20instrumentation%20application%20and%20design%204th.pdf
2.	Leislie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurement",Prentice Hall of India, New Delhi, 2nd Edition, 2015.
3.	https://scilab.in/textbook_companion/generate_book/125

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester			

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV73	**Remote Sensing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to

- Study the basic concepts in Remote Sensing.
- To understand the EOS.
- To study Data Reception & Processing.
- To study applications & Resources Management
- To understand image classification and Modeling.

Course Outcomes	At the end of the course, the student should be able to,	**Knowledge Level**
	CO1: Understand the foundations of remote sensing	K2
	CO2: Explain the different types of remote sensing systems and their characteristics in terms of resolutions	K2
	CO3: Identify the various sensing and imaging techniques	K3
	CO4: Perform the appropriate satellite image analysis for specific Applications	K3
	CO5: Classify the types of Radar Sensing System for real time applications	K3
Pre-requisites	**Satellite Communication & Analog to Digital Communication.**	

CO / PO Mapping (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	
CO 2	3	2											3		2
CO 3	3	3	2		1								3	2	
CO 4	3	3	3		2								3		2
CO 5	3	3	2		1		1						3	2	

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**Concepts and Foundations of Remote Sensing**	Periods	**9**

Introduction, Energy Sources and Radiation Principles, Energy Interactions in the Atmosphere, Physical basis of Signatures of Earth features, Characteristics of Remote Sensing Systems, Global Navigation Satellite Systems (GNSS), An overview of Data Recaption and Data products, Geographic Information Systems (GIS).

Unit – II	**Earth Observation Systems (EOS) and Platforms**	Periods	**9**

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Introduction, Classification of EOS-Infrared-Visible optical sensors (IVOS): Photographic cameras, Television Cameras, Opto-mechanical Scanners, Push-broom Cameras, Multispectral and Hyperspectral imagers-Microwave EOS: Passive microwave sensors, Active microwave sensors, Synthetic Aperture Radars, Ground Penetrating Radars- Principles of Satellite Motion: Types of orbits, Orbit perturbations, Space craft Elements and GNSS.			
Unit – III	**Data Reception and Processing**	Periods	**9**
Introduction, Data formats, Data acquisition and onboard data handling, Data reception system, Data pre-processing – Radiometric and Geometric rectifications, Referencing Scheme, Data products generation, Data products Output media, Data Analysis and Quality Assessment, Special processing, digital and visual interpretation.			
Unit – IV	**Applications of EOS in Earth Resources Management**	Periods	**9**
Agriculture and Soils, Forestry, Geology, Land Cover – Land use Mapping, Water resources, Snow and Glaciers, Urban studies, Coastal zone management and marine fisheries, Desertification, Archaeology.			
Unit – V	**EOS Image Classification and Spatial Data Modeling and Management**	Periods	**9**
Introduction, Supervised and unsupervised classification concepts and methods, Change detection applications, Geographic information systems – Spatial data types, Data preparation and management, GIS working environment, Spatial data infrastructure.			
		Total Periods	**45**
Text Books			
1.	George Joseph & Jeganathan C., "Fundamentals of Remote Sensing", 3rd Edition, Universities Press (India) Pvt. Ltd., Hyderabad, 2018.		
2.	Thomas M. Lillesand, Ralph W. Kiefer, "Remote Sensing And Image Interpretation", 7th Edition, John Wiley, New Delhi, 2015		
References			
1.	Campbell J.B. & Randolph H. Wayne, "Introduction to Remote sensing", 5th Edition, Guilford Press, USA, 2011.		
E-Resources			
1.	http://www.geoservis.ftn.uns.ac.rs/downloads/ISP/1999-fundamentals-of-remote-sensing.pdf		
2.	https://www.geokniga.org/bookfiles/geokniga-remote-sensing-and-image-interpretation.pdf		
3.	https://ncert.nic.in/textbook/pdf/kegy307.pdf		

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV74	**Automotive Electronics**	OE	3	0	0	40	60	100

Course Objective

The main objective of the course is to

- Illustrate the basic knowledge about automotive systems.
- Explain the characteristics of automotive sensors and actuators.
- Develop the concepts of automotive actuators in modern vehicles
- understand the basic knowledge of electronics in vehicular architecture
- understand the fundamentals of automotive networking in new generation vehicles.

Course Outcome

At the end of the course, the student should be able to,	Knowledge level
CO1: Apply the fundamentals and concept of electronics in automotive industry.	K2
CO2: Analyze the functionalities of automotive sensors.	K3
CO3: Analyze the concepts of automotive actuators in modern vehicles.	K3
CO4: Apply the basic knowledge of electronics in vehicular architecture.	K2
CO5: Asses the most suitable networking topologies for a new generation automotive systems.	K4

Pre-requisites -

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	2		

Course Assessment Methods

Direct

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

Indirect

2. Course - end survey

Content of the syllabus

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Unit – I	**AUTOMOTIVE ELECTRONICS FUNDAMENTALS**	Periods	**8**
Electronics Fundamentals: Semiconductor Devices, Transistors-FET, Digital Circuits: Binary Number System, Logic Circuits (Combinatorial), Sensor types: Engine-speed sensors, Hall phase sensors, Speed sensors for transmission control, High-pressure sensors, Temperature sensors, Accelerator-pedal sensors, Steering-angle sensors.			
Unit - II	**AUTOMOTIVE SYSTEM ARCHITECTURE**	Periods	**10**
Overview, Vehicle system architecture, Electronic control unit: Operating conditions, Design, Data processing, Digital modules in the control unit. Basic principles of networking: Network topology, Network organization, OSI reference model, Control mechanisms. Automotive networking: Cross-system functions, Requirements for bus systems, Classification of bus systems, Applications in the vehicle, coupling of networks,			
Unit – III	**ELECTRONIC TRANSMISSION CONTROL**	Periods	**9**
Antilock Braking System (ABS): System overview, Requirements placed on ABS, Dynamics of a braked wheel, ABS control loop, Typical control cycles. Traction Control System (TCS): Tasks, Function description, Structure of traction control system (TCS), Typical control situations, Electronic Stability Program (ESP): Requirements, Tasks and method of operation.			
Unit - IV	**AUTOMOTIVE INSTRUMENTATION**	Periods	**9**
Electronic Diesel Control (EDC): System overview, Common-rail system for passenger cars, Data processing, Torque-controlled EDC systems, Data exchange with other systems, Serial data transmission (CAN). Active steering, Vehicle security systems: Acoustic signaling devices, Central locking system, Locking systems, Biometric systems.			
Unit – V	**AUTOMOTIVE NETWORKING**	Periods	**9**
Bus systems: CAN Bus, High/Low speed CAN, network nodes, Topology, bus topology, logic bus states and coding, transmission agent and bus coupling, Bluetooth: overview, applications, transmission technology, frequency hopping method, modulation method, piconet, scatternet, Bluetooth architecture.			
		Total Periods	**45**

Text Books	
1.	Konrad Reif -Automotive Mechatronics_ Automotive Networking, Driving Stability Systems, Electronics- Springer Vieweg © Springer Fachmedien Wiesbaden 2015.
2.	Najamuz Zaman (auth.)-Automotive Electronics Design Fundamentals-Springer International Publishing (2015).
References	
1.	Robert Bosch GmbH, Bosch Automotive Electrics and Automotive Electronics_ Systems and Components, Networking and Hybrid Drive-Springer Vieweg (2014).
2.	William Ribbens-Understanding Automotive Electronics, Fifth Edition-Newnes (1998)
3.	W.H.Crouse ,Automobile Electrical Equipment, McGraw-Hill, 1996.
4.	P.L.Kholi, Automotive Electrical Equipment, Tata McGraw-Hill, 1995.
5.	BOSCH Automotive Handbook", Robert Bosche, 2011
E-Resources	
1.	*https://download.e-bookshelf.de/download/0003/9285/11/L-G-0003928511-0013264716.pdf*
2.	http://www.engineering108.com/Data/Engineering/Automobile/Understanding-Automotive-Electronics.pdf
3.	http://fmcet.in/AUTO/AT6502_uw.pdf

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV75	**Industry 4.0**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Learn and understand the Importance of IoT in industrial applications • Apply the IoT concepts in building solutions to Industrial problems • To learn about the basics of IOT protocols • To apply the concept of IOT in the real world scenario	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the elements of IoT to build a total control plane in an Industrial application	K2
	CO2: Realize the importance of Data Analytics in IoT.	K3
	CO3: Understand the concepts of Protocols.	K4
	CO4: Study various IoT platforms and Security	K3
	CO5: Understand the concepts of Design Thinking.	K3
Pre-requisites	-	

CO / PO Mapping (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	1	-	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 2	1	1	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 3	1	-	-	2	2	1	-	-	-	2	3	1	1	1	1
CO 4	1	-	1	1	2	2	-	-	-	3	2	3	2	2	1
CO 5	1	-	-	2	2	1	-	-	-	2	3	1	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

Content of the syllabus

Unit – I	**INDUSTRIAL IoT**	Periods	**9**

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

Unit – II	**IIOT ANALYTICS**	Periods	**9**

Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia

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Programming, Data Management with Hadoop			
Unit – III	**PROTOCOLS AND CLOUD**	Periods	**9**
Needof protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, BACnet, BLE, Modbus, SPI, I2C, IIoT protocols –COAP, MQTT, 6LoWPAN, LWM2M, AMPQ IIoT cloud platforms: Overview of COTS cloud platforms, Predix, PTC Thing Worx, Microsoft Azure etc. Data analytics, cloud services, Business models: SaaS, PaaS, IaaS.			
Unit – IV	**IOT SECURITY**	Periods	**9**
Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT			
Unit – V	**CASE STUDY**	Periods	**9**
Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries			
		Total Periods	**45**

Text Books	
1.	"Industrial Internet of Things: Cyber manufacturing Systems" by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017
2.	Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress), 2017
References	
1.	Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.
2.	The Internet of Things: Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi,2ndEdition, Willy Publications 2017
E-Resources	
1.	https://download.e-bookshelf.de/download/0007/6832/86/L-G-0007683286-0014731014.pdf
2.	https://www.ifm.eng.cam.ac.uk/uploads/DIAL/industrial-internet-of-things-report.pdf

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**		Semester		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV76	**Digital Video Processing**	3	0	0	3	40	60	100

Course Objective

The main objective of the course is to
- Analyse the difference between analog and digital video.
- Identify motion detection, estimation and compensation.
- Know about video processing techniques
- Learn fundamentals of video compression techniques
- solve real-world video applications and propose solutions

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Demonstrate the difference between analog and digital video, usage of digital videos, how digital videos are acquired, stored, different video file formats and spatio-temporal imagery.	K2
	CO2: Perform techniques for motion analysis such as motion detection, estimation and compensation.	K3
	CO3: Apply video processing techniques such as enhancement, segmentation for dynamic imagery in order to perform higher level analysis	K3
	CO4: Learn fundamentals of video compression techniques and their applications	K4
	CO5: Identify as well as apply these techniques to solve real-world video applications and propose solutions for the same.	K3

Pre-requisites -

CO / PO Mapping (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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	2		

Course Assessment Methods

Direct
4. Continuous Assessment Test I, II & III 5. Assignment: Simulation using tool 6. End-Semester examinations
Indirect
2. Course - end survey

Content of the syllabus

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Unit – I	DIGITAL VIDEO FORMATION	Periods	9
Introduction to digital video and digital video processing, Analog versus Digital, Analog to Digital, Digital Video Standards- Video acquisition, CCD and CMOS Sensors, Video sampling and interpolation- Interlaced and Progressive scanning- Video file formats- Storage devices, NVR, DVR- Different types of Video Cameras, IP Camera			
Unit - II	**MOTION ANALYSIS**	Periods	**9**
Motion Detection – Hypothesis testing with Fixed/Adaptive thresholding Motion Estimation-Pixel based approaches- Block matching approaches- Motion compensation for videos			
Unit – III	**VIDEO ENHANCEMENT:**	Periods	**8**
Video artifacts – Spatio-temporal noise filtering- Order statistics filtering, Blotch detection and Removal			
Unit - IV	**GUARANTEED SERVICE MODEL**	Periods	**9**
Scene change detection- Motion segmentation- Video shot boundary detection- Motion tracking-contour based tracking-Feature based tracking			
Unit – V	**VIDEO COMPRESSION TECHNIQUES:**	Periods	**10**
Inter frame coding-MPEG-1,MPEG-2 and MPEG-4video compression standards – Low bit rate approaches- H.261 and H.264			
		Total Periods	**45**

Text Books

1.	Yao.Wang, Jom Ostermann, & Ya-Oin Zhang, "Video Processing & Communications", Prentice Hall, 2002. (ISBN 0-13-017547-1)
2.	A. Murat Tekalp, "Digital Video Processing, Pearson Education", Prentice Hall, 2015. (ISBN-10: 0-13-399100-8)

References

1.	Oge Marques, "Practical Image and Video Processing using MATLAB", Wiley-IEEE Press. 2011.
2.	H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia – Iain E.G. Richardson, Wiley, 2003
3.	Al Bovik, "Handbook of Image & Video Processing", Academic Press, 2000. (ISBN: 0121197905)
4.	J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", Academic Press, 2006. (ISBN 0-12-088516-6)
5.	lain E.G. Richardson, "H.264 and MPEG-4 Video Compression: Video Coding for Next Generation Multimedia", Wiley, 2003. (ISBN: 978-0-470-86960-4)

E-Resources

1.	*https://preetikale.files.wordpress.com/2018/07/handbook-of-image-and-video-processing-al-bovik1.pdf*
2.	https://yslaiseblog.files.wordpress.com/2013/10/gfx-multimedia-making-it-work-8th-edition.pdf
3.	https://doc.lagout.org/network/H.264%20and%20MPEG4%20Video%20Compression.pdf
4.	https://ptgmedia.pearsoncmg.com/images/9780133991000/samplepages/9780133991000.pdf
5.	https://books.google.co.in/books/about/Digital_Image_Sequence_Processing_Compre.html?id=tXqmDwAAQBAJ&redir_esc=y

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV77	**Administrative Theories**	3	0	0	3	40	60	100

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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	1	-	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 2	1	1	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 3	1	-	-	2	2	1	-	-	-	2	3	1	1	1	1
CO 4	1	-	1	1	2	2	-	-	-	3	2	3	2	2	1
CO 5	1	-	-	2	2	1	-	-	-	2	3	1	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

Content of the syllabus

Unit – I		Periods	**9**
Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration			
Unit – II		Periods	**9**
Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory			
Unit – III		Periods	**9**
Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.			
Unit – IV		Periods	**9**
Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making			
Unit – V		Periods	**9**
Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker			
		Total Periods	**45**

References

1.	. Crozior M : The Bureaucratic phenomenon (Chand)
2.	Blau. P.M and Scott. W : Formal Organizations (RKP)
3.	**Presthus. R : The Organizational Society (MAC)**
4.	Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
5.	Keith Davis : Organization Theory (MAC)

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV78	**Indian Administrative System**	3	0	0	3	40	60	100

CO / PO Mapping (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	1	-	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 2	1	1	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 3	1	-	-	2	2	1	-	-	-	2	3	1	1	1	1
CO 4	1	-	1	1	2	2	-	-	-	3	2	3	2	2	1
CO 5	1	-	-	2	2	1	-	-	-	2	3	1	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

Content of the syllabus

Unit – I		Periods	**9**
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India			
Unit – II		Periods	**9**
Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government			
Unit – III		Periods	**9**
Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992			
Unit – IV		Periods	**9**
Coalition politics in India, Integrity and Vigilance in Indian Administration			
Unit – V		Periods	**9**
Corruption – Ombudsman, Lok Pal & Lok Ayuktha			
		Total Periods	**45**

References

1.	. S.R. Maheswari : Indian Administration
2.	Khera. S.S : Administration in India
3.	Presthus. R : The Organizational Society (MAC)
4.	. Ramesh K. Arora : Indian Public Administration
5.	Basu, D.D : Introduction to the Constitution of India

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

Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECV79	Principles Of Public Administration	3	0	0	3	40	60	100

CO / PO Mapping
(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	1	-	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 2	1	1	-	2	2	2	-	-	-	3	3	3	2	2	1
CO 3	1	-	-	2	2	1	-	-	-	2	3	1	1	1	1
CO 4	1	-	1	1	2	2	-	-	-	3	2	3	2	2	1
CO 5	1	-	-	2	2	1	-	-	-	2	3	1	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

Content of the syllabus

Unit – I		Periods	**9**

Meaning, Nature and Scope of Public Administration -. Importance of Public Administration - Evolution of Public Administration

Unit – II		Periods	**9**

New Public Administration -New Public Management - Public and Private Administration

Unit – III		Periods	**9**

Relationships with Political Science, History and Sociology -Classical Approach - Scientific Management Approach

Unit – IV		Periods	**9**

Bureaucratic Approach: Max Weber - Human Relations Approach : Elton Mayo -Ecological Approach : Riggs

Unit – V		Periods	**9**

. Leadership: Leadership - Styles - Approaches - Communication: Communication Types - Process - Barriers - Decision Making: Decision Making - Types, Techniques and Processes.

	Total Periods	**45**

References

1.	Avasthi and Maheswari: Public Administration in India, Agra:Lakshmi Narain Agarwal,2013.
2.	Ramesh K Arora: Indian Public Administration, New Delhi: Wishwa Prakashan, 2012.
3.	R.B. Jain: Public Administration in India,21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.
4.	Rumki Basu: Public Administration:Concept and Theories, New Delhi:Sterling, 2013.
5.	R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 2015

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**V**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE1	**Speech Processing**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Understand fundamentals of speech production and related parameters of speech. • Analysis and predict Speech distortion and Pattern Comparison • Understand different speech modeling procedures and their implementation issues. • Familiarize the speech recognition and weight age of acoustics • Understand text to speech synthesis methods	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Model speech production system and describe the fundamentals of speech.	K2
	CO2: Extract and compare different speech parameters.	K3
	CO3: Choose an appropriate statistical speech model for a given application.	K2
	CO4: Design a speech recognition system.	K3
	CO5: Use different speech synthesis techniques.	K2
Pre-requisites	**Digital Signal Processing**	

CO / PO Mapping (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	2									3	2	1
CO 2	3	3	2	2									3	2	1
CO 3	3	3	2	2									3	2	1
CO 4	3	3	2	2									3	2	1
CO 5	3	3	2	2									3	2	1

Course Assessment Methods

Direct
1.Continuous Assessment Test I, II & III 2.Assignment 3.End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

Unit – I	**BASIC CONCEPTS**	Periods	**9**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds;

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Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short- Time Fourier Transform, Filter-Bank and LPC Methods.			
Unit – II	**SPEECH ANALYSIS**	Periods	**9**
Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.			
Unit – III	**SPEECH MODELING**	Periods	**9**
Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.			
Unit – IV	**SPEECH RECOGNITION**	Periods	**9**
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.			
Unit – V	**SPEECH SYNTHESIS**	Periods	**9**
Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, Intelligibility and naturalness – role of prosody, Applications and present status..			
		Total Periods	**45**

Text Books	
1.	Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2012.
2.	L.R.Rabiner, R.W.Schafer, "Digital Processing Of Speech Signals", Pearson Education 4th Edition, 2009.
3.	Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
References	
1.	Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 1997.
2.	Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition",Pearson Education, 2002.
3.	Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.
4.	Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
5.	Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.
E-Resources	
1.	https://research.iaun.ac.ir/pd/mahmoodian/pdfs/UploadFile_2643.pdf
2.	http://mu.ac.in/wp-content/uploads/2014/04/SPEECH-RECOGNITION.pdf
3.	https://doc.lagout.org/science/0_Computer%20Science/9_Others/1_Digital%20Signal%20Processing/The%20Scientist%20and%20Engineer%27s%20Guide%20to%20DSP.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE2	**Biomedical Instrumentation**	OE	3	0	0	40	60	100

Course Objective

The main objective of the course is to

- Know about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- Illustrate about the various assist devices used in the hospitals.
- Understand the diagnostic instruments, therapeutic instruments and imaging systems.
- Understand the different methods of measurements of biological parameters
- give an introductory idea about human physiology system.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Recall the structure of cell, physiology of different biological systems and their functions.	K2
	CO2: Illustrate the types of electrodes and measurements of biological parameters.	K3
	CO3: Explain the working of diagnostic instruments, therapeutic instruments and imaging systems.	K4
	CO4: Analyze the different methods of measurements of biological parameters.	K3
	CO5: Compare the different techniques of measurement.	K4

Pre-requisites -

CO / PO Mapping
(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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	2		

Course Assessment Methods

Direct

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

Indirect

3. Course - end survey

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Content of the syllabus

Unit – I	ELECTRO PHYSIOLOGY	Periods	8

Cell-and Its Structure - Electrical, Mechanical and Chemical Activities - Action and Resting Potential- Organization of Nervous System - CNS - PNS - Neurons - Axons- Synapse - Propagation of Electrical Impulses along the Nerve-Sodium Pump - Cardio Pulmonary System- Physiology of Heart, Lung, Kidney.

Unit - II	BIO POTENTIAL ELECTRODES AND TRANSDUCERS	Periods	8

Design-of Medical Instruments - Components of Biomedical Instrument-System - Electrodes: Micro Electrodes, Needle Electrodes, Surface Electrodes -Instrumentation amplifier - Biomedical Measurements Like pH, PCO2, PO2 of Blood, Isolation Amplifier, Preamplifier, Current Amplifier, Chopper Amplifier.

Unit – III	INSTRUMENTS USED FOR DIAGNOSIS	Periods	10

ECG, Einthoven Triangle, Leads, Electrodes, Vector Cardiograph, Measurement of Cardiac Output, EEG, EMG, Plethysmography, Blood Flow Measurements, Holter Monitor- Respiratory Rate Measurement - Oximeter, Bone Density Measurement, Patient Monitoring System, ICCU.

Unit - IV	MODERN IMAGING SYSTEM	Periods	10

Ultrasonic Diagnosis, Ultrasonic Scanning, Isotopes in Medical Diagnosis- Pace Makers, Defibrillators, Doppler Monitor(colour), Medical imaging-X-ray generation, DXA, Radiographic & Fluoroscopic Techniques - Image Intensifiers-Computer Aided Tomography, PET, SPECT- Laser Applications-Echocardiography-CT Scan Qualitative and Quantitative-MRI/ NMR-Endoscopy.

Unit – V	RECENT TRENDS AND INSTRUMENTS FOR THERAPY	Periods	9

Dialysers - Surgical Diathermy - Electro Anaesthetic and Surgical Techniques. Sources of Electric Hazards and Safety Techniques. Single Channel Telemetry, Multi channel Telemetry, Implantable Telemetry, Wireless Telemetry, Telemedicine, Telemedicine Applications.

Total Periods	**45**

Text Books

1.	Khandpur, “Handbook of Biomedical Instrumentation” 2nd Edition, Tata McGraw Hill, 2003.
2.	Arumugam M., “Biomedical Instrumentation”, Anuradha Publications, Reprint 2009.

References

1.	Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007.
2.	John G.Webster, ―Medical Instrumentation Application and Design‖, 3rd Edition, Wiley India Edition, 2007.
3.	Joseph J.Carr and John M.Brown, ―Introduction to Biomedical Equipment Technology‖, John Wiley and Sons, New York, 2004.
4.	Tompkins W.J. and Webster J.G., "Design of Microcomputer Based Medical Instrumentation", Prentice Hall, 1991.
5.	Geddes L.A. and Baker L.E., "Principle of Applied Biomedical Instrumentation" 3rd Edition, Wiley, 1989.

E-Resources

1.	*https://www.academia.edu/39250912/Handbook_of_Second_Edition_Biomedical_Instrumentation*
2.	https://www.worldcat.org/title/biomedical-instrumentation-and-measurements/oclc/5492641/editions?referer=di&editionsView=true&fq=
3.	http://library.nuft.edu.ua/ebook/file/Webster2006.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**V**		

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE3	**Automotive Electronics**	OE	3	0	0	40	60	100

Course Objective	The main objective of the course is to • Illustrate the basic knowledge about automotive systems. • Explain the characteristics of automotive sensors and actuators. • Develop the concepts of automotive actuators in modern vehicles • understand the basic knowledge of electronics in vehicular architecture • understand the fundamentals of automotive networking in new generation vehicles.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Apply the fundamentals and concept of electronics in automotive industry.	K2
	CO2: Analyze the functionalities of automotive sensors.	K3
	CO3: Analyze the concepts of automotive actuators in modern vehicles.	K3
	CO4: Apply the basic knowledge of electronics in vehicular architecture.	K2
	CO5: Asses the most suitable networking topologies for a new generation automotive systems.	K4
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	2		

Course Assessment Methods

Direct
4. Continuous Assessment Test I, II & III 5. Assignment: Simulation using tool **6.** End-Semester examinations
Indirect
4. Course - end survey

Content of the syllabus

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Unit – I	**AUTOMOTIVE ELECTRONICS FUNDAMENTALS**	Periods	**8**
Electronics Fundamentals: Semiconductor Devices, Transistors-FET, Digital Circuits: Binary Number System, Logic Circuits (Combinatorial), Sensor types: Engine-speed sensors, Hall phase sensors, Speed sensors for transmission control, High-pressure sensors, Temperature sensors, Accelerator-pedal sensors, Steering-angle sensors.			
Unit - II	**AUTOMOTIVE SYSTEM ARCHITECTURE**	Periods	**10**
Overview, Vehicle system architecture, Electronic control unit: Operating conditions, Design, Data processing, Digital modules in the control unit. Basic principles of networking: Network topology, Network organization, OSI reference model, Control mechanisms. Automotive networking: Cross-system functions, Requirements for bus systems, Classification of bus systems, Applications in the vehicle, coupling of networks,			
Unit – III	**ELECTRONIC TRANSMISSION CONTROL**	Periods	**9**
Antilock Braking System (ABS): System overview, Requirements placed on ABS, Dynamics of a braked wheel, ABS control loop, Typical control cycles. Traction Control System (TCS): Tasks, Function description, Structure of traction control system (TCS), Typical control situations, Electronic Stability Program (ESP): Requirements, Tasks and method of operation.			
Unit - IV	**AUTOMOTIVE INSTRUMENTATION**	Periods	**9**
Electronic Diesel Control (EDC): System overview, Common-rail system for passenger cars, Data processing, Torque-controlled EDC systems, Data exchange with other systems, Serial data transmission (CAN). Active steering, Vehicle security systems: Acoustic signaling devices, Central locking system, Locking systems, Biometric systems.			
Unit – V	**AUTOMOTIVE NETWORKING**	Periods	**9**
Bus systems: CAN Bus, High/Low speed CAN, network nodes, Topology, bus topology, logic bus states and coding, transmission agent and bus coupling, Bluetooth: overview, applications, transmission technology, frequency hopping method, modulation method, piconet, scatternet, Bluetooth architecture.			
		Total Periods	**45**

Text Books	
3.	Konrad Reif -Automotive Mechatronics_ Automotive Networking, Driving Stability Systems, Electronics- Springer Vieweg © Springer Fachmedien Wiesbaden 2015.
4.	Najamuz Zaman (auth.)-Automotive Electronics Design Fundamentals-Springer International Publishing (2015).
References	
6.	Robert Bosch GmbH, Bosch Automotive Electrics and Automotive Electronics_ Systems and Components, Networking and Hybrid Drive-Springer Vieweg (2014).
7.	William Ribbens-Understanding Automotive Electronics, Fifth Edition-Newnes (1998)
8.	W.H.Crouse ,Automobile Electrical Equipment, McGraw-Hill, 1996.
9.	P.L.Kholi, Automotive Electrical Equipment, Tata McGraw-Hill, 1995.
10.	BOSCH Automotive Handbook", Robert Bosche, 2011
E-Resources	
4.	*https://download.e-bookshelf.de/download/0003/9285/11/L-G-0003928511-0013264716.pdf*
5.	http://www.engineering108.com/Data/Engineering/Automobile/Understanding-Automotive-Electronics.pdf
6.	http://fmcet.in/AUTO/AT6502_uw.pdf

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VI**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
U19ECOE4	**Satellite Communication**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues • Enable the student to understand the necessity for satellite based communication, the essential elements involved and the transmission methodologies. • Enable the student to understand the different interferences and attenuation mechanisms affecting the satellite link design • Expose the student to the advances in satellite based navigation, GPS and the different application scenarios. • Study different applications of satellite communication.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Demonstrate the basic principle of satellite communication and understand the concepts used in a Satellite Communication system.	K5
	CO2: Enumerate the segment of satellite and analyze the parameters of uplink and downlink system	K3
	CO3: Classify and compare different access techniques in free space communication	K4
	CO4: Understand the aspects behind Satellite links and Earth Station and Gain knowledge about Earth station and understand the networking in satellite communication	K2
	CO5: Analyze the different applications of Satellite Communication and its considerations	K4
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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							2			3		2
CO 2	3	3	2	2			2						3		
CO 3	3	3	2	2						2			3	2	
CO 4	3	2	2	2			2							2	
CO 5	3	2	2											2	

Course Assessment Methods

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

Signature of BOS Chairman ECE

1. Course - end survey

Content of the syllabus

Unit – I	**SATELLITE ORBITS**	Periods	**9**

Kepler's Laws, orbital elements, orbital perturbations, station keeping,–apogee and perigee heights, inclined orbits. The geo stationary orbits- Look Angle Determination- Limits of visibility –eclipse-Sub satellite point – Sun transit outage-Launching orbits

Unit – II	**SPACE SEGMENT AND SATELLITE LINK DESIGN**	Periods	**9**

Introduction- Power supply, Attitude and Orbit control, Thermal control and Propulsion, transponders, the antenna subsystems. Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design,EIRP, Transmission Losses, link power budget equation, System noise,C/N calculation, inter modulation and interference, inter-satellite links.

Unit – III	**SATELLITE ACCESS**	Periods	**9**

Introduction, single access, preassigned FDMA, demand assigned FDMA, spade system, FDMA downlink analysis, TDMA-basic equipment in TDMA system, preassigned and demand assigned TDMA, downlink analysis for digital transmission, comparison of uplink power requirements for FDMA and TDMA, satellite-switched TDMA.CDMA-DSS, code signal ,acquisition and tracking, spectrum spreading and dispreading, CDMA throughput.

Unit – IV	**EARTH SEGMENT AND SATELLITE IN NETWORKS**	Periods	**9**

Earth Station- Introduction, TVRO, MATV, CATV, Transmit and Receive earth stations. Satellite in networks-introduction, bandwidth, asynchronous transfer mode, ATM over satellite, satellite links and TCP, Enhancing TCP over satellite channels using standard mechanism, request for comments, split TCP connections.

Unit – V	**SATELLITE APPLICATIONS**	Periods	**9**

DBS-Introduction, orbital spacing, power rating and number of transponders, frequency an polarization, transponders capacity, bit rates for digital television, MPEG compression standards, forward error correction, the home indoor and outdoor unit, downlink analysis, HDTV, Video frequency bandwidth, Satellite mobile services, INTELSAT Series, INSAT, VSAT, Radarsat, GPS, Orbcomm ,polar orbiting satellites.

	Total Periods	**45**

Text Books

1.	Dennis Roddy, "Satellite Communication", McGraw Hill International, 4th Edition, 2010.
2.	Timothy Pratt, Charles W. Bostian, "Satellite Communications", John Wiley & Sons, 2nd Edition, 2009.

References

1.	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 3rd Edition, 2007.
2.	N. Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3.	Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.
4.	M. O. Kolawole, "Satellite Communication Engineering", Marcel Dekker, Inc. NY,2nd Edition ,2013.
5.	M. Richharia, "Satellite Systems for Personal Applications", John Wiley, 2010.

E-Resources

1.	https://www.srecwarangal.ac.in/ec downloads/IV_II%20satellite_communications_by_dennis_roddy4thedition.pdf
2.	https://www.scribd.com/doc/105119756/Solutions-Manual-for-Satellite-Communications-Second-edition-Timothy-Pratt-Charles-Bostian-Jeremy-Allnutt
3.	https://www.gettextbooks.com/author/M_Richharia

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VI**			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE5	**VLSI Design and its Applications**	OE	3	0	0	40	60	100

Course Objective

The main objective of the course is to

- Design DSP architectures that are suitable for VLSI implementation for a given algorithm.
- Enable students to design VLSI systems with high speed.
- Learn high-level algorithms that reduce the number of multipliers, area of implementation and power consumption.
- Equip students to design VLSI systems with low power.
- Address issues related to high performance VLSI architectures such as pipelining styles.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Develop efficient DSP algorithms suitable for VLSI implementations.	K3
	CO2: Understand the data path components and optimization techniques.	K2
	CO3: Develop scheduling and allocation algorithms in High level synthesis.	K3
	CO4: Design the digital systems by applying power optimization techniques.	K3
	CO5: Design of memories for various architectures including network on chip	K5
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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										3		
CO 2	3	3	2	2						2			3	2	
CO 3	3	3	2	2				2					3	2	
CO 4	3	2	2	2									3	2	
CO 5	3	2	2										3		2

Course Assessment Methods

Direct

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1.Continuous Assessment Test I, II & III

2.Assignment

3.End-Semester examinations

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**APPLICATION SPECIFIC ARCHITECTURE**	Periods	**9**
Application specific architectures for DSP applications; Systolic arrays (automated mapping procedures); DSP processors; Multi-core architectures.			
Unit – II	**DATA PATH DESIGN AND OPTIMIZATION**	Periods	**9**
A brief review of data path components (fast adders and multipliers); pipelining and parallel processing of digital filters (non-recursive and recursive).			
Unit – III	**HIGH LEVEL SYNTHESIS**	Periods	**9**
Scheduling and allocation algorithms (list-based and force-directed scheduling, ILP).			
Unit – IV	**LOW POWER DESIGN OF DIGITAL SYSTEMS**	Periods	**9**
Optimizations at the system-level, algorithm level and architecture level; case studies.			
Unit – V	**MEMORY DESIGN TECHNIQUES**	Periods	**9**
Memory design for embedded systems, design issues for battery powered systems, reliable computing, Network-on-Chip architectures, 3D architectures.			
		Total Periods	**45**

Text Books

1.	Vijay K. Madisetti, "VLSI Digital Signal Processors: An Introduction to Rapid Proto- typing and Design Synthesis", IEEE Press. 1995. (Reprint 2012).
2.	S. Y. Kung, "VLSI Array Processors", Prentice Hall. 1988.

References

1.	K. K. Parhi, "VLSI Digital Signal Processing Systems. Design and Implementation", Wiley. 2014
2.	A. Raghunathan, N. K. Jha and S. Dey, "High-Level Power Analysis and Optimization", Kluwer Academic Publishers, 1988(Reprint 2012).
3.	Y. Tsividis, "Mixed Analog Digital VLSI Devices and Technology (An introduction), World Scientific", New Jersey, 2002
4.	Lars Wanhammer, DSP Integrated Circuits, 1999 Academic press, New York
5.	Gary Yeap, Practical Low Power Digital VLSI Design, Kluwer, 1997.

E-Resources

1.	https://www.worldcat.org/title/vlsi-array-processors/oclc/16405063
2.	http://www.gbv.de/dms/ilmenau/toc/249310074.PDF
3.	https://www.worldcat.org/title/practical-low-power-digital-vlsi-design/oclc/807875581?referer=di&ht=edition

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VI**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE6	**Digital Image Processing**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues • Study the formation of an image and its acquisition • Introduce the use and application of transforms in image processing • Study techniques for improving quality of information in spoilt images • Introduce schemes for compressing images to save storage space	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the fundamentals of digital image processing.	K2
	CO2: Evaluate various image transforms.	K6
	CO3: Apply various techniques for image enhancement and restoration techniques.	K4
	CO4: Utilize appropriate preprocessing techniques for manipulation of images	K3
	CO5: Design automated techniques for image based applications	K3
Pre-requisites	-	

CO / PO Mapping (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					2					3	2	
CO 2	3	3	2	2				2		2			3		2
CO 3	3	3	2	2									3	2	
CO 4	3	2	2	2				2		2			3		2
CO 5	3	2	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

Content of the syllabus

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Unit – I	DIGITAL IMAGE FUNDAMENTALS	Periods	9
Elements of digital image processing systems, steps in image processing, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, image sampling and quantization, relationship between pixels, mathematical tools used in image processing. 2D sampling, sampling theorem, aliasing and Moire patterns.			
Unit – II	**IMAGE TRANSFORMS**	Periods	**9**
2D transforms - DFT, DCT, DST, Walsh, Hadamard, Slant and Haar wavelet transforms.			
Unit – III	**IMAGE ENHANCEMENT AND RESTORATION**	Periods	**9**
Intensity transformations, histogram processing, smoothing spatial filters, sharpening spatial filters. Image restoration: Degradation/ restoration process, noise models, noise probability distributions, spatial filtering, mean filters, order statistics filters. Estimating the degradation function, Inverse filtering, Wiener filtering, constrained least squares filtering.			
Unit – IV	**IMAGE SEGMENTATION AND REPRESENT**	Periods	**9**
Point, line and edge detection, edge linking and boundary detection, thresholding – global, multiple and variable, multivariable thresholding, region growing, region splitting and merging. Image representation: Boundary following, chain codes, polygonal approximations, signatures, boundary segments and skeletons.			
Unit – V	**IMAGE COMPRESSION**	Periods	**9**
Fundamentals, basic compression methods – Huffman coding, arithmetic coding, LZW coding, run length coding, block transform coding and wavelet coding, Digital image watermarking, JPEG standard, MPEG.			
		Total Periods	**45**

Text Books

1.	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing", Pearson Prentice Hall, 3rd Edition, 2008.
2.	S. Annadurai and R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education, 2007.

References

1.	Anil K- Jain- 'Fundamentals of Digital Image Processing'- Pearson/Prentice Hall of India- 2012
2.	William K. Pratt, "Digital Image Processing", John Wiley, NewYork, 2002.
3.	Digital Image Processing, S Jayaraman, S Esakkirajan T Veerakumar, Mc Graw-Hill, 2010.
4.	Digital Image Processing, K.William Pratt, John Wiley, 1997.
5.	Image Processing Theory, Algorithm and Architectures, M.A.Sid Ahmed,McGraw-Hill, 1995.

E-Resources

1.	http://web.ipac.caltech.edu/staff/fmasci/home/astro_refs/Digital_Image_Processing_2ndEd.pdf
2.	https://www.cis.rit.edu/class/simg361/Notes_11222010.pdf
3.	http://ultra.sdk.free.fr/docs/DxO/Fundamentals%20of%20Digital%20Image%20Processing.pdf

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Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VII**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE7	**Basics of Communication Systems**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Introduce analog and digital communication techniques. • Impart knowledge on data communication techniques. • Introduce the pulse communication techniques. • Develop knowledge on multi–user radio communication. • Understand the GSM and CDMA technologies.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Apply analog and digital communication techniques.	K2
	CO2: Apply data communication techniques.	K2
	CO3: Analyze the pulse communication techniques.	K3
	CO4: Utilize multi–user radio communication.	K2
	CO5: Analyze the GSM and CDMA technologies.	K2
Pre-requisites	-	

CO / PO Mapping (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	2					2					3	3	
CO 2	3	2	2	2				2		2			3		2
CO 3	3	3	2	2									3	2	
CO 4	3	2	2					2		2			3		2
CO 5	3	2	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

Content of the syllabus

Unit – I	**FUNDAMENTALS OF ANALOG COMMUNICATION**	Periods	**9**

Principles of amplitude modulation – AM envelope, frequency spectrum and bandwidth – modulation index and percent – modulation, AM Voltage distribution, AM power distribution – Angle modulation –

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FM and PM waveforms – phase deviation and modulation index – frequency deviation and percent modulation – Frequency analysis of angle modulated waves – Bandwidth requirements for Angle modulated waves.			
Unit – II	**DIGITAL MODULATION TECHNIQUES**	Periods	**9**
Amplitude shift keying – frequency shift keying – FSK bit rate and baud rate – FSK transmitter – BW consideration of FSK – FSK receiver – phase shift keying – binary phase shift keying – QPSK – Quadrature Amplitude modulation – bandwidth efficiency – DPSK.			
Unit – III	**DATA COMMUNICATION**	Periods	**9**
Data Communication: History of Data Communication – Standards Organizations for Data Communication –Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques Data communication Hardware – serial and parallel interfaces.			
Unit – IV	**PULSE COMMUNICATION**	Periods	**9**
Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).			
Unit – V	**MULTI–USER RADIO COMMUNICATION**	Periods	**9**
Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand off –Satellite Communication – Bluetooth.			
		Total Periods	**45**
Text Books			
1.	Wayne Tomasi, "Advanced Electronic Communication Systems", Pearson Education, 6th Edition 2009.		
2.	Simon Haykin, "Communication Systems",John Wiley & Sons, 4th Edition, 2007.		
References			
1.	Rappaport T.S, "Wireless Communications: Principles and Practice", Pearson Education, 2nd Edition ,2010.		
2.	Martin S.Roden, "Analog and Digital Communication System", Prentice Hall of India, 3rd Edition ,2009.		
3.	B.Sklar, "Digital Communication Fundamentals and Applications", Pearson Education, 2nd Edition, Reprint2018.		
E-Resources			
1.	https://gradeup-question-images.grdp.co/liveData/f/2017/12/Advanced_Electronic_Communications_Systems_0130453501.pdf-86.pdf		
2.	https://ict.iitk.ac.in/wp-content/uploads/EE320A-Principles-Of-Communication-CommunicationSystems-4ed-Haykin.pdf		
3.	https://www.egr.msu.edu/~tongli/Introduction-WCN.pdf		

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Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VII**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE8	**Wireless Sensor Networks**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Learn Sensor Network fundamentals. • Understand the different routing protocols. • Have an in-depth knowledge on sensor network architecture and design issues • Understand the transport layer and security issues possible in Sensor networks • Have an exposure to mote programming platforms and tools.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Explain the concepts, network architectures and applications of wireless sensor networks	K2
	CO2: Discuss the Challenges in designing network level protocols for MAC, Routing, time synchronization and Localization	K3
	CO3: Simulate sensor network protocols in the Tiny OS environment	K3
	CO4: Design and implement wireless sensor networks.	K4
	CO5: Apply knowledge of wireless sensor networks to various application areas.	K4
Pre-requisites	-	

CO / PO Mapping
(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**
CO1	3	2	2									2	2		
CO2	2	3	2	2									2	2	
CO3	2		3	3									3	3	
CO4	2							2					2	2	
CO5	3	2	2									2	2		

Course Assessment Methods

Direct
4. Continuous Assessment Test I, II & III 5. Assignment: Simulation using tool 6. End-Semester examinations
Indirect
2. Course - end survey

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Content of the syllabus			
Unit – I	**OVERVIEW OF WIRELESS SENSOR NETWORKS**	Periods	**9**
The vision of Ambient Intelligence – Application Examples – Types of Applications – Challenges for Wireless Sensor Networks – Comparison of Mobile ad hoc networks and wireless sensor networks – Enabling Technologies for Wireless Sensor Networks.			
Unit - II	**ARCHITECTURES**	Periods	**9**
Single-Node Architecture – Hardware Components – Energy Consumption of Sensor Nodes – OperatingSystems and Execution Environments – Network Architecture – Sensor Network Scenarios – Optimization Goals and Figures of Merit – Gateway Concepts			
Unit – III	**NETWORKING SENSORS**	Periods	**9**
Physical Layer and Transceiver Design Considerations – MAC Protocols for Wireless Sensor Networks – Low Duty Cycle Protocols and Wakeup Concepts – S-MAC – The Mediation Device Protocol – Wakeup Radio Concepts – Address and Name Management – Assignment of MAC Addresses – Routing Protocols – Energy – Efficient Routing, Geographic Routing.			
Unit - IV	**INFRASTRUCTURE ESTABLISHMENT**	Periods	**9**
Topology Control – Clustering – Time Synchronization – Localization and Localization services			
Unit – V	**SENSOR NETWORK PLATFORMS AND TOOLS**	Periods	**9**
Sensor Node Hardware – Berkeley Motes – Programming Challenges – Node-level software platforms –Node-level Simulators – State-centric programming.			
		Total Periods	**45**

Text Books	
1.	Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication,2015
2.	FeiHu ,Xiaojun Cao , " Wireless Sensor Networks , Principles and Practice CRC Press ,2010
References	
1.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols and Applications", John Wiley, 2015.
2.	Ian Akyildiz , Mehmet Can Vuran "Wireless Sensor Networks" John Wiley & Sons USA 2010.
3.	Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.
4.	WaltenegusDargie, Christian Poellabauer ,"Fundamentals of Wireless Sensor Networks: Theory and Practice '(Wiley) July 2010
5.	Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000.
E-Resources	
1.	http://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf
2.	http://feihu.eng.ua.edu/-%20Fei%20Hu%20-%20WSN%20Textbook.pdf
3.	http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02

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Programme	**B.E.**	Programme Code		**103**	Regulation		**2019**	
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester		**VII**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19ECOE9	**PCB Design and Fabrication**	3	0	0	3	40	60	100

Course Objective	The main objective of the course is to • Study of basics of PCBs and design of analog, digital, microwave circuits etc.. • Study about layout design and planning, packaging and checking rules. • Study about designing of special circuits such as fast pulse circuits, high frequency circuits, and power electronics circuits. • Explicate about the aspects behind soldering, assembly and re-working techniques. Analyze quality, reliability and environmental concerns in PCB designing industry.	
Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Relate the different concepts used in electronics system design	K3
	CO2: Identify basic PCB design rules, layout and checklist parameters.	K2
	CO3: Estimate the aspects behind PCB soldering and quality control.	K5
	CO4: Determine every aspects of system design like soldering. Testing, control quality, safety aspects and re-working techniques.	K3
	CO5: Design to know the different design of analog, digital, high frequency circuits and fast pulse circuits.	K3
Pre-requisites	-	

CO / PO Mapping
(3/2/1 indicates strength of correlation) **3-Strong, 2 – Medium, 1 - Weak**

COs	Programme Outcomes (POs)												**CO/PSO Mapping** 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					2					3	2	
CO 2	3	3	2	2				2		2			3		2
CO 3	3	3	2	2									3	2	
CO 4	3	2	2	2				2		2			3		2
CO 5	3	2	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

Content of the syllabus

Unit – I	**BASICS OF PRINTED CIRCUIT BOARDS**	Periods	**9**

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Evolution of printed circuit boards-Classification of Printed Circuit Boards-Manufacturing of Basic Printed Circuit Boards-Challenges in Modern PCB Design and Manufacture-PCBs with Embedded Components-Electronic Components-Variable Capacitors and Resistors –Linear Integrated Circuits-Digital Integrated Circuits-Surface Mount Devices.			
Unit – II	**LAYOUT PLANNING AND DESIGN**	Periods	**9**
Reading drawing and diagrams-General PCB Design Considerations-Mechanical Design Considerations-Electrical design considerations, conductor patterns, component placement rules , environmental factors, cooling requirements and packaging density, layout design ,layout design checklist.			
Unit – III	**DESIGN CONSIDERATIONS FOR SPECIAL CIRCUITS**	Periods	**9**
Design rules for Analog circuits, Design rules for Digital circuits, Design rules for High frequency circuits, Design rules for Fast pulse circuits, Design rules for PCBs for Microwave circuits, Design rules for Power electronic circuits, High density interconnect structures, Electromagnetic interference/ compatibility			
Unit – IV	**SOLDERING, ASSEMBLY AND RE-WORKIN(TECHNIQUE**	Periods	**9**
Soldering- introduction , theory, variables, materials, brazing. Soldering tools, hand soldering ,PCB assembly process, solder paste for SMDS, Mass soldering, quality control of solder joints ,health and safety aspects, re-work and repair of PCBs and repairing surface mounted PCBs.			
Unit – V	**QUALITY,RELIABILITY AND ENVIRONMENTAL CONCERNS IN PCB INDUSTRY**	Periods	**9**
Quality assurance, testing of quality control, quality control methods, testing of PCBs, reliability testing. Pollution control in PCB industry, polluting agents, recovery techniques, recycling of PCBs, safety precautions and toxic chemicals in PCB fabrications, lead free soldering.			
		Total Periods	**45**
Text Books			
1.	R.S.Khandpur, " Printed Circuit Boards",Tata Mcgraw- Hill publishing company limited, New Delhi, 1st Edition ,2009.		
2.	Bosshart,W.C, "printed circuit boards", Tata Mcgraw- Hill publishing company limited, NewDelhi,2014..		
References			
1.	Ross,M.W. and Leonida,G. "General Principles of Design and Layout" ,Circuit World,2005.		
2.	Purdie. D,"Repairing/Modifing Surface Mount PCBs", Electronics Production, 2001		
3.	Jon Varteresian, "Fabricating Printed Circuit Boards", Elsevier Science, 2002.		
4.	Charles Hamilton ,"A Guide to Printed Circuit Board Design", Elsevier Science, 2013.		
5.	Winstanely, A., "The Soldering and Desoldering Guide".Internet Notes, www.epemag.wimborne.co.uk.		
E-Resources			
1.	https://books.google.co.in/books?id=cIwiBAAAQBAJ&pg=PA415&lpg=PA415&dq=Bosshart,W.C,+%E2%80%9Cprinted+circuit+boards%E2%80%9D,+Tata+Mcgraw-+Hill+publishing+company+limited,+New+Delhi,2014..		
2.	https://www.google.co.in/books/edition/Printed_Circuit_Boards/VY8iBAAAQBAJ?hl=en&gbpv=1&dq=R.S.Khandpur,+%E2%80%9C+Printed+Circuit+Boards&printsec=frontcover		
3.	http://bibliotecadigital.usbcali.edu.co/bitstream/10819/6149/1/Tarjetas_Circuitos_Ruteadora_Ayala_2018.pdf		

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**B.E.**	Programme Code	**103**		Regulation	**2019**		
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**				Semester			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MCSY3	**NUMERICAL ABILITY**	3	0	0	-	100	-	100

Content of the syllabus

Unit – I	**NUMBER SYSTEM**	Periods	**6**
Number Properties – HCF – LCM - Square root – Cube root – Simplification – Averages.			
Unit - II	**DIRECT PROPORTIONAL PROBLEMS**	Periods	**8**
Percentage - Profit & Loss –. Ratio & Proportions – Mixture & Allegations - Problem on Ages			
Unit – III	**INDIRECT PROPORTIONAL PROBLEMS**	Periods	**8**
Time & Work – Pipes & Cisterns - Time, Speed & Distance – Boats & Streams – Races & Games of Skills			
Unit - IV	**BANKER'S PROBLEMS**	Periods	**4**
Simple Interest – Compound Interest – Logarithms – Partnership - Discounts.			
Unit – V	**MISCELLANEOUS PROBLEMS**	Periods	**4**
Mensuration: Area & perimeter – Volume & Surface Area – Geometry-Trigonometry.			
		Total Periods	**30**

Text Books

1.	Dinesh Khattar- The Pearson guide to Quantitative Aptitude for Competitive Examinations 3rd edition.

References

1.	R.S. Aggarwal - Quantitative Aptitude for Competitive Examinations

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Programme	**B.E./ B.Tech.**	Programme Code	**103**	Regulation	**2019**
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MCSY4	**Verbal Ability**	3	0	0	-	100	-	100

Content of the syllabus

Unit – I	**TENSES**	Periods	**6**

Purpose and rules of tenses and its keywords (focus should be given to present continuous, future continuous, present perfect, future perfect, present perfect continuous, past perfect continuous, future perfect continuous with more examples) - Direct and Indirect Speech – Voices.

Unit - II	**ARTICLES**	Periods	**6**

Purpose of Articles: Indefinite Article: If you want to say about ANY item, you should use the articles A / An. **A :** A European, A One Eyed beggar, A University, A Useful Website. Name of professions, Expression of quantity, To make a Proper noun a Common noun, With certain numbers, used before the word 'Half' when it follows a whole number. **Exceptions: Choosing A or An** 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. Prepositions Of Time-On, In, At, Since, For, Ago, During, Before, After, Until, Till, To/Past, From/To, By
b. Prepositions Of Place- In, At, On, Off, By, Beside, Under, Over, Below, Above, Up And Down, Ago
c. Prepositions Of Directions/ Movements Across, Through, To, Into, Out Of, Onto, Towards, From
d. Other Prepositions- Of, By , About, For, With
e. Prepositions Usage with Its Context

Unit – III	**SENTENCE CORRECTION**	Periods	**6**

SENTENCE CORRECTION

a) In each of the following sentences, four options are given. You are required to identify the best

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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 the 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 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

A little tact would have saved the situation(some tact).

Lay and Lie Lay, laid

Unit - IV	**SENTENCE COMPLETION**	Periods	**6**

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

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

Unit – V	**VOCABULARY**	Periods	**6**

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

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Programme	**B.E./ B.Tech.**	Programme Code	**103**	Regulation	**2019**			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester				
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MCTY5	**Logical Reasoning**	3	0	0	-	100	-	100

Content of the syllabus

Unit – I	**VERBAL REASONING**	Periods	**6**

Coding – Decoding(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) , Analogy (Direct and Simple Analogy, Completing the Analogues pair, Choosing the Analogues pair, Choosing the similar word, Number Analogy, Alphabet Analogy), Classification(Choosing the odd words, Choosing the odd pair of words, Choosing the odd letter group, Choosing the odd number and odd pair of numbers), Alphabet Test(Arrangement according to dictionary, Alpha-Numeric sequence, Letter word problems, Rule detection), Word Formation (Using letters from a given word, By unscrambling words)

Unit - II	**SITTING ARRANGEMENT & SENSE TEST**	Periods	**6**

Sitting Arrangement (Arrangement in a line, Arrangement around of a circle, square and rectangle, Arrangement around pentagonal and hexagonal, **Direction Sense Test**[(Main, Cardinal and Shortest Direction)Final Detection, Displacement, Direction and Displacement], **Number, Ranking, Time sequence Test** (Number Test, Ranking Test, Time Sequence Test), Puzzles (Based on classification, Based on placing and comparison, Family Based problems)

Unit – III	**NUMBER AND LETTER SERIES**	Periods	**6**

Number and Letter Series[(Number Series: 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) , Letter Series (Alphabet Series, Continuous pattern of series)], **Inserting the missing character, Age, Blood** (Jumbled up descriptions, Relation puzzles, Coded Relations), **Clock and calendar** (Mathematical operations and Notations- Problem of solving by substitution, Interchanging signs and numbers, Deriving the appropriate conclusions), **Logical order of words, Clerical aptitude** (Question based on address, Question based on issues**)**

Unit - IV	**LOGICAL AND ANALYTICAL REASONING**	Periods	**6**

Logical venn diagrams (Universal positive, Universal Negative, Universal Affirmative or Negative, Miscellaneous, Geometrical Figures on Venn Diagrams), **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.**

Unit – V	**DATA INTERPRETATION &FLOW CHART**	Periods	**6**

Input – Output (Shifting, Arranging),**Data Interpretation** (Table chart, Bar chart, Pie chart, Miscellaneous chart, Mixed chart), Cube(no of sided painted, Full cube, cutting cube), **Flow chart** (Description flow chart, Value updating flow chart), **Quantitative reasoning, Logical deduction, Deductive reasoning, Binary logic**

Total Periods	**30**

Text Books

1.	How to crack Test of Reasoning- Jai kishan and Prem kishan – arihant Publication

References

1.	How to prepare logical reasoning for CAT- Arun Sharama – Mc Graw Hill Publication

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Programme	**B.E.**	Programme Code	**103**	Regulation	**2019**			
Department	**ELECTRONICS AND COMMUNICATION ENGINEERING**			Semester	**VI**			
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U19MCTY6	**PERSONALITY DEVELOPMENT**	3	0	0	-	100	-	100

Content of the syllabus

Unit – I	**NUMERICAL ABILITY**	Periods	**8**

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

Unit - II	**LOGICAL REASONING**	Periods	**8**

Coding Decoding – Blood Relations – Direction Sense Test – Seating Arrangement – Number Series – Syllogisms – Venn Diagrams – Statements – Data Interpretation – Data Sufficiency – Clocks & Calendars - Miscellaneous

Unit – III	**SOFT SKILLS & VERBAL ABILITY**	Periods	**8**

Resume Preparation – Mock GD – Interview Etiquette – Mock Interview – Reading Comprehension – Essay Writing

Unit - IV	**TECHNICAL SKILLS I**	Periods	**8**

Recap of C – Variables & Datatypes – Console IO Operations – Operators & Expressions – Control Flow Statements – Working with Functions – Working with Arrays

Unit – V	**TECHNICAL SKILLS II**	Periods	**8**

Pointers – String Handling – Structures & Unions – File Handling – Pre Processor Directives – Command Line Arguments & Variables – Searching & Sorting – Stack – Queue – Linked List - Trees

	Total Periods **40**

References

1	Quantum CAT by Sarvesh Verma – Arihant Publications
2	Quantitative 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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