VIVEKANANDHA

COLLEGE OF ENGINEERING FOR WOMEN

(An Autonomous Institution Affiliated to Anna University-Chennai)
Approved by AICTE – Accredited by NAAC and ISO 9001:2008 Certified
Elayampalayam, Tiruchengode – 637 205,
Namakkal District, Tamilnadu.

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

M.E- POWER SYSTEMS ENGINEERING

(CURRICULUM & SYLLABUS -2019)

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

(Regulation 2019)

COLLEGE VISION

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

COLLEGE MISSION

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

DEPARTMENT VISION

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

DEPARTMENT MISSION

The Mission of the Electrical and Electronics Engineering Department is

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

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

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

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

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

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

PROGRAM OUTCOMES (PO's)

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's):

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

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

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

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

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEO'S) WITH PROGRAMME OUTCOMES (PO'S)

A broad relation between the programme objective and the outcomes is given in the following table

Programme Educational Objectives	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	√	√	√	√	√				√			√
II	√	√	√	√	√	√	√	√	√	√	√	√
III		√	√			√	√	√	√	√	√	√
IV												

Year	SEM	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
YEAR 1	SEM 1	Power System Operation and Control	√	√	√	√	√	√	√				√	√
		Digital Power system Protection	√	√		√			√		√	√	√	
		Advanced Power System Analysis	√	√	√	√	√	√		√	√		√	
		Optimization Techniques	√	√	√	√	√				√	√	√	√
		Professional Elective - I												
		Professional Elective - II												
		Audit Course -I												
		Power System Simulation Lab- I	√	√	√	√	√			√	√		√	√
	SEM 2	High Voltage DC Transmission systems	√	√	√			√	√				√	√
		Restructured Power Systems	√	√	√			√		√			√	
		Power system Automation	√	√	√				√				√	
		Professional Elective - III												
		Professional Elective -IV												
		Audit Course -II												
		Power System Simulation Lab -II	√	√	√	√	√			√	√		√	√
YEAR 2	SEM 3	Professional Elective - V												
		Open Elective												
		Project Phase -I	√	√	√	√	√	√	√	√	√	√	√	√
	SEM 4	Project Phase -II	√	√	√	√	√	√	√	√	√	√	√	√

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**
CURRICULUM (Applicable to the students admitted from the academic year 2019 - 2020 onwards)					

Course Code	Course Name	CAT	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
P19PS101	Power System Operation and Control	PCC	3	0	0	3	40	60	100
P19PS102	Digital Power system Protection	PCC	3	0	0	3	40	60	100
P19PS103	Advanced Power System Analysis	PCC	3	0	0	3	40	60	100
P19MA103	Optimization Techniques	HS	3	0	0	3	40	60	100
	Professional Elective - I	PEC	3	0	0	3	40	60	100
	Professional Elective - II	PEC	3	0	0	3	40	60	100
	Audit Course -I	PAC	2	0	0	0	100	-	100
PRACTICAL									
P19PS104	Power System Simulation Lab- I	PCC	0	0	4	2	60	40	100
Total Credits						**20**	**400**	**400**	**800**

PCC – Professional Core Course, PEC – Program Elective Course, PAC- Program Audit Course, CA - Continuous Assessment, ESE - End Semester Examination, HS – Humanity Science

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING /** **ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**
CURRICULUM (Applicable to the students admitted from the academic year 2019 - 2020 onwards)					

Course Code	Course Name	CAT	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
P19PS205	High Voltage DC Transmission systems	PCC	3	0	0	3	40	60	100
P19PS206	Restructured Power Systems	PCC	3	0	0	3	40	60	100
P19PS207	Power system Automation	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
	Audit Course -II	PAC	2	0	0	0	100	-	100
PRACTICAL									
P19PS208	Power System Simulation Lab -II	PCC	0	0	3	2	60	40	100
Total Credits						**17**	**360**	**340**	**700**

PCC – Professional Core Course, PEC – Program Elective Course, PAC- Program Audit Course, CA - Continuous Assessment, ESE - End Semester Examination

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING /** **ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**III**
CURRICULUM (Applicable to the students admitted from the academic year 2019 - 2020 onwards)					

Course Code	Course Name	CAT	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
	Professional Elective - V	PEC	3	0	0	3	40	60	100
	Open Elective	OEC	3	0	0	3	40	60	100
PRACTICAL									
P19PS310	Project Phase - I	EEC	0	0	20	10	60	40	100
Total Credits						**16**	**140**	**160**	**300**

PEC – Program Elective Course, OEC – Open Elective Course,
EEC – Employability Enhancement Course, CA - Continuous Assessment,
ESE - End Semester Examination

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING /** **ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**IV**
CURRICULUM (Applicable to the students admitted from the academic year 2019 - 2020 onwards)					

Course Code	Course Name	CAT	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
PRACTICAL									
P19PS411	Project Phase - II	EEC	0	0	32	16	60	40	100
Total Credits						**16**	**60**	**40**	**100**

EEC – Employability Enhancement Course, CA - Continuous Assessment,
ESE - End Semester Examination

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING /** **ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	-

CURRICULUM

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

PROFESSIONAL ELECTIVE – I

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE01	Power System Planning and Reliability	3	0	0	3	40	60	100
P19PSE02	Analysis of Inverters	3	0	0	3	40	60	100
P19PSE03	High Power Converters	3	0	0	3	40	60	100
P19PSE04	Analysis and Computation of Electromagnetic Transients in Power	3	0	0	3	40	60	100
P19PSE05	Power Quality	3	0	0	3	40	60	100
P19PSE06	Power System Stability	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE – II								
P19PSE07	Electrical Power Distribution Systems	3	0	0	3	40	60	100
P19PSE08	Power System Economics	3	0	0	3	40	60	100
P19PSE09	Electric and Hybrid Vehicles	3	0	0	3	40	60	100
P19PSE10	Energy Management and Auditing	3	0	0	3	40	60	100
P19PSE11	Non Conventional Energy Systems	3	0	0	3	40	60	100
P19PSE12	Fuzzy Systems	3	0	0	3	40	60	100

Signature of the BOS chairman, EEE

PROFESSIONAL ELECTIVE – III								
P19PSE13	Power Electronics for Renewable Energy	3	0	0	3	40	60	100
P19PSE14	Advanced Digital Signal Processing	3	0	0	3	40	60	100
P19PSE15	Dynamics of Electrical Machines	3	0	0	3	40	60	100
P19PSE16	Soft Computing Techniques	3	0	0	3	40	60	100
P19PSE17	Computer Aided Power System Analysis	3	0	0	3	40	60	100
P19PSE18	Modeling and Analysis of Electrical Machines	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE – IV								
P19PSE19	Advanced Microcontroller Based Systems	3	0	0	3	40	60	100
P19PSE20	SCADA System and Applications	3	0	0	3	40	60	100
P19PSE21	System Theory	3	0	0	3	40	60	100
P19PSE22	AI Techniques	3	0	0	3	40	60	100
P19PSE23	Power Electronics Applications to Power Systems	3	0	0	3	40	60	100
P19PSE24	Waste Management and energy Recovery	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE – V								
P19PSE25	Power electronic Drives	3	0	0	3	40	60	100
P19PSE26	Energy conservation in Electrical systems	3	0	0	3	40	60	100
P19PSE27	Industrial Load Modeling and Control	3	0	0	3	40	60	100
P19PSE28	Advanced energy storage technologies	3	0	0	3	40	60	100
P19PSE29	Power System Security	3	0	0	3	40	60	100
P19PSE30	Smart Grid Technology and Applications	3	0	0	3	40	60	100

Signature of the BOS chairman, EEE

OPEN ELECTIVES								
P19PSOE2	Industrial Safety	3	0	0	3	40	60	100
P19PSOE6	Waste to Energy	3	0	0	3	40	60	100

CA - Continuous Assessment, ESE - End Semester Examination

Audit Course: I

S.NO	COURSE CODE	COURSE NAME	CATEGORY	L	T	P	C	Maximum Marks		
								CA	ESE	T
1	P19PSAC1	Research Methodology and IPR	AC	2	0	0	0	100	0	100
2	P19PSAC2	Pedagogy Studies	AC	2	0	0	0	100	0	100
3	P19PSAC3	Disaster Management	AC	2	0	0	0	100	0	100
4	P19PSAC4	Value Education	AC	2	0	0	0	100	0	100
Audit Course : II										
5	P19PSAC5	Constitution of India	AC	2	0	0	0	100	0	100
6.	P19PSAC6	English for Research Paper Writing	AC	2	0	0	0	100	0	100
7	P19PSAC7	Personality Development through Life Enlightenment Skills.	AC	2	0	0	0	100	0	100
8	P19PSAC8	**Online Courses**	AC	2	0	0	0	100	0	100

Signature of the BOS chairman, EEE

Type of Courses

PCC	:	Professional Core Courses
PEC	:	Professional Elective Courses
OEC	:	Open Elective Courses
AC	:	Audit Courses
EEC		Employability Enhancement Course
HS	:	Humanities And Social Sciences
EEC		Employability Enhancement Course

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PS101	**Power System operation and Control**	3	0	0	3	60	40	100
Course Objective	The students should made to • Learn the voltage control methods and reactive power compensation techniques. • Analyze the unit commitment and economic dispatch scheduling. • Learn the control methods and energy management system of power system network							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: understand the voltage control methods and reactive power compensation techniques.							K2
	CO2: Analyze the unit commitment problems.							K4
	CO3: Analyze the economic dispatch problems.							K4
	CO4: Understand the control methods and energy management system of power system network							K2
	CO5: Apply the state estimation in power system network.							K3
Pre-requisites	Power System Analysis							

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	2											3	2			
CO 2	3	3			2							3	3	2	3	
CO 3	3	3			2							3	3	2	3	
CO 4	2											3	3			
CO 5	2	2										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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**REACTIVE POWER AND VOLTAGE CONTROL**	Periods	**9**
Production and absorption of reactive power – Methods of voltage control – Shunt reactors – Shunt Capacitors – Series capacitors – Synchronous condensers – Static VAR systems – Principles of Transmission system compensating– Modeling of reactive compensating devices.			
Unit - II	**UNIT COMMITMENT**	Periods	**9**
Constraints in unit commitment – Spring reverse – Thermal unit constraints – Other constraints – Solution using priority list method, Dynamic programming method – Forward DP approach, lagrangian relaxation method.			
Unit – III	**GENERATION SCHEDULING**	Periods	**9**
The Economic dispatch problem – Thermal system dispatch problem – Thermal system dispatching with network losses considered – The lambda – iteration method – Gradient method of economic dispatch – Economic dispatch with piecewise linear cost functions – Transmission system effects – Incremental loses and penalty factors – Hydro thermal scheduling using DP			
Unit - IV	**CONTROL OF POWER SYSTEMS**	Periods	**9**
Review of AGC and reactive power control system operating states by security control functions – Monitoring – Energy control centre – SCADA System – Functions - monitoring data acquisition and controls – EMS System			
Unit – V	**STATE ESTIMATION**	Periods	**9**
Maximum likelihood weighted least squares estimation: Concepts – Matrix formulation – Example for weighted least squares states estimation :state estimation of an AC network :Typical results of states estimation on an AC network – States estimation by orthogonal decomposition algorithm – Introduction to advanced topics : detection and identification of bad measurements,estimation of quantities not being measured , network observability and pseudo measurements – Application of power systems state estimation.			
		Total Periods	**45**

Text Books	
1.	Kothari.D.P and Nagrath.I.J, –Modern Power System Analysis‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 4th Edition, 2011.
2.	Chakrabarti and Halder, ―Power System Analysis: Operation and Control‖, Prentice Hall of India, 3rd Edition, 2010.
References	
1.	Kundur.P, –Power System Stability and Control‖, Tata McGraw Hill Publisher, USA, 2006.
2.	Hadi Saadat, ―Power System Analysis‖, 11th Reprint, 2007.
3.	Grigsby.L.L, ―The Electric Power Engineering, Hand Book‖, CRC Press and IEEE Press, 2001.
4.	Olle.I.Elgerd, ―Electric Energy Systems theory - An introduction‖, Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.
5.	Allen J. Wood and Bruce F. Wollenberg, ―Power Generation, Operation and Control, John Wiley and Sons Inc., 2nd Edition, 2006.
E-Resources	
1.	https://www.vidyarthiplus.com/vp/Thread-EE2401-Power-System-Operation-and-Control-Hand-Written-Notes-Lavanya-Edition#.XdUSrNIzbcs
2.	http://studentsfocus.com/ee8702-psoc-notes-power-system-operation-and-control-notes-eee-7th-sem/
3.	https://nptel.ac.in/courses/108101040/

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PS102	**Digital Power system Protection**	3	0	0	3	40	60	100

Course Objective

The students should made to
- Learn about the various schemes of numerical protection and over current protection.
- Illustrate concepts of digital protection scheme of transmission line.
- Facilitate the concepts of synchronous generator and transformer protection.
- Analyze distance and carrier protection and Coordination.
- Familiarize the concepts of short circuit studies and PC application.

Course Outcome

At the end of the course, the student should be able to,	**Knowledge Level**
CO1: Illustrate fundamental knowledge about various protection schemes.	K2
CO2: Apply familiarity about the digital protection of transmission lines.	K3
CO3: Develop acquire knowledge in synchronous generator and transformer Protection.	K3
CO4: Analyze proficient in man-machine interface and protection schemes.	K4
CO5: Discuss the PC based application studies in digital protection.	K6

Pre-requisites

Protection and Switchgear.

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	3	2	2			1			3	2	1	2		1	2
CO 2	3	2	3	2						2	1		3		2	
CO 3	3	2		3							2	2	2		1	
CO 4	3			3		2	2	2				2	3		2	2
CO 5	3				1				2	2	1	2	3	2		2

Course Assessment Method

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**NUMERICAL PROTECTION**	Periods	**9**
Introduction- Block diagram of numerical relay- sampling theorem – correlation with reference wave- Least Error Squared (LES) technique- digital filtering and numerical over- current protection.			
Unit – II	**DIGITAL PROTECTION OF TRANSMISSION LINE**	Periods	**9**
Introduction- protection scheme of transmission line- distance relays- travelling wave relays- digital protection scheme based upon fundamental signal – hardware design – digital protection of EHV/UHV transmission line based upon travelling wave phenomenon - new relaying scheme using amplitude comparison.			
Unit – III	**DIGITAL PROTECTION OF SYNCHRONOUS GENERATOR AND POWER TRANSFORMER**	Periods	**9**
Introduction- Faults in synchronous generator – protection schemes of synchronous generator – digital protection of synchronous generator – Faults in a transformer- schemes used for transformer protection – digital protection of transformer.			
Unit – IV	**DISTANCE AND OVER CURRENT RELAY, SETTING AND COORDINATION**	Periods	**9**
Directional Instantaneous IDMT over current relay – Directional multi-Zone distance relay – Distance relay setting – Co-ordination of distance relays - Co-ordination of over current relays – Computer graphics display – Man-machine interface subsystem – Integrated operation of national power system – Application of computer graphics.			
Unit – V	**PC APPLICATION IN SHORT CIRCUIT STUDIES FOR DESIGNING RELAYING SCHEME**	Periods	**9**
Types of faults- assumptions- development of algorithm for SC studies – PC based integrated software for SC Studies - Transformation to component quantities- SC studies of multiphase systems – Ultra high speed protective relays for high voltage long transmission lines.			
		Total Periods	**45**

Text Books

1.	Singh L.P., ―Digital Protection‖, Second edition New Age International (P) Limited, New Delhi, 1997.
2.	Paithankar, ‗Transmission Network Protection‖, Marcel & Dekker, New York, 1998.

References

1.	A.T. Johns and S.K.Salman, ―Digital Protection for Power Systems‖, Peter Peregrinus Ltd., Institution of Electrical Engineers, 1995.
2.	Stanley Horowitz, ―Protective Relaying for Power system II‖, John Wiley & Sons, 2008.
3.	Badri Ram and D.N. Vishwakarma, ―Power System Protection and Switchgear‖, Tata McGraw-Hill Publishing Company, 2002.
4.	Juan M. Gers and Edward J. Holmes, ―Protection of Electricity Distribution Networks‖, The Institution of Engineering and Technology, 2011.
5.	Y.G. Paithankar and S.R Bhide, ―Fundamentals of Power System Protection‖, Prentice-Hall of India, 2003

E-Resources

1.	http://www.tandfonline.com/loi/uemp19
2.	http://www.idc-online.com/technical references/pdfs/electrical engineering/Types and Revolution of Electrical.pdf
3.	https://www.udemy.com/course/electrical-control-protection-systems/

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205									
Programme	**M.E**	Programme code			**202**	Regulation		**2019**		
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**					Semester		**I**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks				
		L	T	P	C	CA	ESE	Total		
P19PS103	**Advanced Power System Analysis**	**3**	**0**	**0**	**3**	**40**	**60**	**100**		

Course Objective

The students should made to

- Perform steady state analysis and fault studies for a power system of any size.
- Explore the nuances of estimation of different states of a power system.
- Calculate the system estimation and find the optimization strategies.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: To construct models of power system components and apply them	K3
	CO2: To solve ac and dc load flow for single and there phase systems	K2
	CO3: To analyze the faults in the power system networks	K3
	CO4: To apply the concepts of optimization in power system	K6
	CO5: To explain the concept of state estimation in power system and the role of statistics in state estimation.	K6
Pre-requisites	Power System Analysis	

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	3	3	1	1	2	1					3	3	1		2
CO 2	2	3	2	3		1		1			2	2	2	1	3	
CO 3	3	2	3	3		1					1	2	3		2	2
CO 4	3	2	3	2	1	2						3	2		2	3
CO 5	3	3	2	2	2	1					2	3	1	3	1	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	**NETWORK MODELING**	Periods	**9**

Network modeling – Single phase and three phase modeling of alternators, transformers and transmission lines, Conditioning of Y Matrix –- Incidence matrix method, Method of successive elimination, Triangular factorization

Signature of the BOS chairman, EEE

Unit - II	LOAD FLOW ANALYSIS	Periods	9
Load flow analysis - Newton Raphson method, Fast Decoupled method, AC-DC load flow – Single and three phase methods – Sequential solution techniques and extension to multiple and multi-terminal DC systems.			
Unit – III	**FAULT STUDIES**	Periods	**9**
Fault Studies -Analysis of balanced and unbalanced three phase faults – fault calculations – Short circuit faults – open circuit faults			
Unit - IV	**SYSTEM OPTIMIZATION**	Periods	**9**
System optimization - strategy for two generator systems – generalized strategies –effect of transmission losses - Sensitivity of the objective function - Formulation of optimal power flow-solution by Gradient method-Newton‘s method			
Unit – V	**STATE ESTIMATION**	Periods	**9**
State Estimation – method of least squares – statistics – errors – estimates – test for bad data – structure and formation of Hessian matrix – power system state estimation			
		Total Periods	**45**

Text Books	
1.	L.P. Singh., _Advanced Power System Analysis and Design‘, New Academic Science Ltd; 6th ed. Edition, 2012.
2.	Syed A. Nasar, F.C. Trutt _Electric Power Systems‘, 1st Edition, Kindle Edition CRC Press, 2011.
References	
1.	Grainger, J.J. and Stevenson, W.D. _Power System Analysis‘ Tata McGraw hill, New Delhi, 2003.
2.	Hadi Saadat, _Power System Analysis‘, Tata McGraw hill, New Delhi, 2002
3.	Arrillaga, J and Arnold, C.P., _Computer analysis of power systems‘ John Wiley and Sons, New York, 1997
4.	Pai, M.A., _Computer Techniques in Power System Analysis‘, Tata McGraw Hill, New Delhi, 2006
5.	Greenwood, Allan, _Electrical Transients In Power Systems, Wiley India Pvt.Ltd, 2nd ED,2010.
E-Resources	
1.	https://nptel.ac.in/courses/108105067/
2.	https://www.vidyarthiplus.com/vp/Thread-PS7101-Advanced-Power-System-Analysis-QB-VEC-2014-15-Edition
3.	https://circuitglobe.com/power-system.html

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205													
Programme	**M.E.**			Programme Code		**202**	Regulation					**2019**		
Department	**POWER SYSTEMS ENGINEERING/ ELECTRICAL AND ELECTRONICS ENGINEERING**						Semester					**I**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks								
		L	T	P	C	CA		ESE				Total		
P19MA103	**Optimization Techniques**	**3**	**0**	**0**	**3**	**40**		**60**				**100**		

Course Objective

The students should made to

- Understand the elementary aspects of statistics and probability theory.
- Analyze and interpret statistical data using appropriate probability distribution.
- Identify testing of hypothesis for all size of samples.
- Identify the formulation and graphical solution of linear programming problem.
- Potentially understand forward and backward recursion.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Inculcate the habit of statistical thinking.	K1, K2
	CO2: Enable to identify various probability distributions.	K2, K3
	CO3: Ability to test the hypothesis using suitable statistical test.	K2, K4
	CO4: Incorporate Transportation and Assignment problems.	K2, K3
	CO5: Recognize Dynamic programming applications using cargo Loading method.	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**	**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 and Seminar.
3. End-Semester examinations.

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**RANDOM VARIABLES**	Periods	**9**
Random Variables-Probability Function-Moments-Moment Generation Function and their Properties-Binomial-Poisson-Geometric, Uniform, Exponential and Normal Distributions			
Unit - II	**TWO DIMENSIONAL RANDOM VARIBLE**	Periods	**9**
Joint Distributions-Marginal and Conditional distributions-Functions of two dimensional random variables-Regression curve-Correlation			
Unit – III	**TESTING OF HYPOTHESIS**	Periods	**9**
Basic Definitions:- (Population, Sampling, Tests of Significance, Testing a Hypothesis, Null Hypothesis, Alternative Hypothesis, Level of Significance, Types of Errors) – Testing of Hypothesis using : ‗t'-Test , ‗F'-Test , Chi Square Test (ψ^2) - Test for Independence of Attributes & Goodness of Fit.			
Unit - IV	**LINEAR PROGRAMMING**	Periods	**9**
Formulation-Graphical solution-Simplex Method -Transportation and Assignment problems			
Unit – V	**DYNAMIC PROGRAMMING**	Periods	**9**
Dynamic Programming-principle of optimality-forward and backward recursion-DP Applications (Cargo Loading method)-Problems of dimensionality.			
		Total Periods	**45**

Text Books	
1.	Montgomery, D.C. and Runger, C.G., Applied Statistics and Probability for Engineers, 6th Edition, Wiley Students Edition, Wiley, 2016.
2.	Ravichandran, J., Probability and statistics for Engineers, 1st Edition, Wiley India Ltd, 2012.
3.	Fox, R.L., ‗Optimization methods for Engineering Design', Addition Wiley, 1981
References	
1.	Gupta S.C. and Kapoor V.K, Fundamentals of Mathematical Statistics, 1st Edition, Sultan an Sons, 2001.
2.	Devore, J.L., Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2011.
3.	Johnson, R.A., Miller, I. and Freund, J., Miller & Freund's Probability and Statistics for Engineers 8th Edition, Pearson Education, 2010.
4.	Rao S.S., Engineering Optimization, Theory and practice, 4th Edition, John Wiley & Sons, Inc. 2009.
5.	Taha, H.A., Operations Research: An Introduction, 9th Edition, Prentice Hall of India, 2010.
E-Resources	
1.	https://www.youtube.com/
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PS104	**Power System Simulation lab -I**	**0**	**0**	**3**	**2**	**60**	**40**	**100**

Course Objective	The students should made to • Analyze simulation results and effective documentation	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Solve the algebraic and differential equations by various methods	K4
	CO2: Form the Y bus by using various methods	K4
	CO3: Analyze the load flow study for AC/DC	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**	**PSO 4**
CO 1	3	2				1							3		1	
CO 2	2	3	2						1				2		2	1
CO 3	3	2	2	2						1			3	2		
CO 4	3		2	3						1			2		1	1
CO 5		3	2	2					1					2		1

Signature of the BOS chairman, EEE

Direct
1. Pre lab &Post lab test 2. End-Semester examinations
Indirect
1. Course - end survey

Content of the syllabus

S.No	LIST OF EXPERIMENTS	Course Outcome	Program Outcome & Program Specific Outcome
1.	Power flow analysis by Newton- Rapshon method	CO2	PO2,PO5, PSO2,PSO3,PSO4
2.	Power flow analysis by fast decoupling method	CO2	PO2,PO5, PSO2,PSO3,PSO4
3.	Power flow analysis by Gauss Seidal method	CO2	PO2,PO5, PSO2,PSO3,PSO4
4.	Simulation of IGBT Inverters.	CO1	PO2,PO5, PSO2,PSO3,PSO4
5.	Simulation of Thyristor Converters.	CO1	PO2,PO5, PSO2,PSO3,PSO4
6.	Transient Stability Studies.	CO1	PO2,PO5, PSO2,PSO3,PSO4
7.	Short Circuit Studies.	CO3	PO2,PO5, PSO2,PSO3,PSO4
8.	Load Forecasting and Unit Commitment.	CO3	PO2,PO5, PSO2,PSO3,PSO4
9.	Economic dispatch using lambda-iteration method	CO1	PO2,PO5, PSO2,PSO3,PSO4
			Total period : 45

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**II**
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PS205	**High Voltage DC Transmission systems**	3	0	0	3	40	60	100
Course Objective	The student should be made to, • Introduce the students with the concept of HVDC transmission system • Familiarize the students with the HVDC converters and their control system • Expose the students to the harmonics and faults occur in the system and their prevention							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1:Understanding the concepts of HVDC power tansmission technology							K2
	CO2: Applying the concepts in Graetz circuits							K3
	CO3: Analyzing the concepts of converter control and power control circuits.							K4
	CO4: Design the concepts Harmonics and Filters							K6
	CO5: Modeling of HVDC systems for Digital Dynamics Simulation							K6
Pre-requisites	Power electronics drives							

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	3	3		1			1			2	2	2	1	1	1
CO 2	3	2	3		2			1			2	2	2	1	1	1
CO 3	3	3	3		2			1			2	3	2	1	1	1
CO 4	3	2	3		1			1			2	3	2	1	1	1
CO 5	3	3	3		1			1			2	3	2	1	1	1

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	**DC POWER TRANSMISSION TECHNOLOGY**	Periods	**9**

Introduction - Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in DC transmission

Unit - II	**ANALYSIS OF HVDC CONVERTERS**	Periods	**9**

Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuits – Converter bridge characteristics– Characteristics of twelve-pulse converter – Detailed analysis of converters.

Signature of the BOS chairman, EEE

Unit – III	CONVERTER AND HVDC SYSTEM CONTROL	Periods	9
General principles of DC Link control – Converter control characteristics – System control hierarchy- Firing angle control – Current and extinction angle control – Starting and stopping of DC link- Power control – Higher level controllers– Telecommunication requirements			
Unit - IV	**HARMONICS AND FILTERS**	Periods	**9**
Introduction – Generation of harmonics – Design of AC filters – DC filters – Carrier frequency and RI noise.			
Unit – V	**SIMULATION OF HVDC SYSTEMS**	Periods	**9**
Introduction – System simulation: Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for Digital Dynamics Simulation.			
		Total Periods	**45**

Text Books	
1.	Padiyar .K .R. , ‗HVDC Power Transmission Systems ‘, New age international(P) Ltd, New Delhi, 2016.
2.	Arrillaga .J, ‗High Voltage Direct Current Transmission‘, Peter Pregrinus London, Second Edition, 1998.
References	
1.	Edward Wilson Kimbark , ‗Direct Current Transmission‘, Vol 1 , Wiley Interscience, Newyork, London, Sydney,1971.
2.	Rakosh Das Begamudre , ‗Extra High Voltage AC Transmission Engineering‘ ,Wiley Eastern Ltd, New Delhi,2006.
3.	Adamson .C and Hingorani N.G., ‗High Voltage Direct Current Power Transmission‖, Garraway Ltd., London, 1967.
4.	Kundur.P, ―Power system stability and control‖, McGraw Hill, 1994.
5.	Sunil S. Rao EHV-AC, HVDC Transmission & Distribution Engineering Paperback – 1993
E-Resources	
1.	https://easyengineering.net/hvdc-power-transmission-systems-by-padiyar/
2.	https://drive.google.com/file/d/1xKdq5ReLaNURTbfdIX6LtGidpWy8hhM8/view
3.	https://www.sciencedirect.com/science/article/pii/S2096511718300720

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205.					
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PS206	**Restructured Power systems**	3	0	0	3	40	60	100

Course Objective	The students should made to • Fundamental knowledge on restructuring of power Markets, understand basics of transmission challenges. • Attain knowledge about congestion management and the pricing of transmission network • Learners will have knowledge on the various power sectors in India.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand Comprehend the process involved in restructuring of power Markets.	K2
	CO2: Analyze the concepts of transmission rights and challenges	K3
	CO3: Interpret knowledge in congestion management methods and ancillary.	K2
	CO4: Analyze the various schemes of transmission pricing.	K3
	CO5: Discuss List the requirements to reform the Indian power sector.	K5
Pre-requisites	Power system analysis	

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	3				3	2	1		2	1	2	3			3
CO 2	3	2	2	3		2	2		2				2	2		
CO 3	3	3		2		1	3	2		2	2	3	1	3	2	
CO 4	2			2		2	2	2				2	2			1
CO 5	3	2	2				1			2	1	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	**FUNDAMENTALS OF POWER MARKETS**	Periods	**9**

Introduction - Fundamentals and structure of Restructured Power Market – Market Power - Power exchange and pool markets - Independent System Operator (ISO) – components - Role of ISO - Operating Experiences of Restructured Electricity Markets in various Countries (UK, Australia, Europe and US).

Signature of the BOS chairman, EEE

Unit – II	TRANSMISSION CHALLENGES	Periods	9
Introduction -Transmission expansion in the New Environment – Role of transmission planning – Transmission Capacity – Total Transfer Capability (TTC) – Computational procedure - Margins – Available transfer capability (ATC) – Principles – Constraints - Methods to compute ATC.			
Unit – III	**CONGESTION MANAGEMENT AND ANCILLARY SERVICES**	Periods	**9**
Concept of Congestion Management – Methods to relieve the congestion - Inter and Intra zonal Congestion Management – Generation Rescheduling - Locational Marginal Pricing (LMP) – Financial Transmission Right (FTR) - Ancillary Services.			
Unit – IV	**TRANSMISSION PRICING**	Periods	**9**
Transmission pricing methods - Postage stamp - Contract path - MW-mile – MVA mile – Distribution Factor method – Tracing method - Short run marginal cost (SRMC) – Generator Ramping and Opportunity Costs.			
Unit – V	**INDIAN POWER MARKET**	Periods	**9**
Current Scenario – Regions – Salient features of Indian Electricity Act 2003 – Regulatory and Policy development in Indian power Sector – Availability based tariff – Necessity – Working Mechanism – Unscheduled Interchange Rate – Operation of two type of Indian Power Exchange.			
		Total Periods	**45**

Text Books	
1.	M. Shahidehpour and M. Alomoush, ―Restructuring Electrical Power Systems‖, Marcel Decker Inc., 2001.
2.	M. Shahidehpour, H. Yamin and Z. Li, ―Market Operations in Electric Power Systems‖, John Wiley & Sons, Inc., 2002.
References	
1.	Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, ―Operation of Restructured Power Systems‖, Kluwer Academic Publishers, 2001.
2.	Loi Lei Lai, ―Power system Restructuring and Regulation‖, John Wiley sons, 2001.
3.	Steven Stoft,‖ Power System Economics: Designing Markets for Electricity‖, John Wiley and Sons, 2002.
4.	Daniel Kirschen and Goran Strbac, ―Fundamentals of Power System Economics‖ John Wiley and Sons, Ltd, 2004.
5.	Sally Hunt,‖ Making competition work in electricity‖, , John Willey and Sons Inc. 2002.
E-Resources	
1.	https://www.academia.edu/33475490/LAI-Power_System_Restructuring_and_Deregulation.pdf
2.	https://nptel.ac.in/courses/108101005/
3.	https://www.lathamathavan.edu.in/lmgi/antiragging/RPS-EEE%20new.PDF

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PS207	**Power System Automation**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Course Objective	The student should be made to, • Study various methods of load flow and their advantages and disadvantages • Understand power system security concepts and studied the methods to rang the contingencies • Study voltage instability phenomenon.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1**:** Understand and design of plc automation.	K3
	CO2: Understand about communication interface of PLC	K2
	CO3: Understand about operation and Control using SCADA	K3
	CO4: Analyze about Substation Automation	K6
	CO5: Analyze about Distribution Automation	K6
Pre-requisites	PLC & SCADA	

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	2		3	
CO 2	3			2	2							2	2	2		
CO 3	3		3									2	2	2		
CO 4	3	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	**PROGRAMMABLE LOGIC CONTROLLERS**	Periods	**9**

Structure of PLC - Control program – Programming: Simple Relay Layouts and Schematics - PLC Connections - Ladder Logic Inputs - Ladder Logic Outputs.

Signature of the BOS chairman, EEE

Unit - II	COMPONENTS OF AUTOMATED SYSTEMS	Periods	9
Sensors, Transducers and Actuators: Forgotten cost - Special considerations - Standardization & Maintenance. Remote Terminal Unit: Communication interface – Protocol detailed –Pulse control – Serial control- Data Storage – Applications			
Unit – III	**SCADA**	Periods	**9**
Definition of SCADA – Applicable processes – Elements of SCADA systems – SCADA Architecture - operation and Control using SCADA - Development from telemetry – Dependence on communications & computers			
Unit - IV	**SUBSTATION AUTOMATION**	Periods	**9**
Introduction – function of substation Automation System - trends of substation Automation - intelligent , affordable substation monitoring and control – remote metering.			
Unit – V	**DISTRIBUTION AUTOMATION**	Periods	**9**
Need for Distribution Automation – Characteristics of Distribution Automation – Feeder Automation – faults in Distribution feeder – fault isolation and restoration.			
		Total Periods	**45**

Text Books	
1.	Dilip Patel –Introduction Practical PLC (Programmable Logic Controller) Programming GRIN Verlag 2009.
2.	Mini S.Thomas, John D.McDonald, Power System SCADA and Smart Grids, CRC Press 2019.
References	
1.	Gary A. Dunning –Introduction to Programmable Logic Controllers Thomson Learning Publications.2006
2.	James Northcote-Green, Robert G. Wilson. –Control and Automation of Electrical Power Distribution Systems, CRC Press, 2006.
3.	Dr. M.K. Khedkar, Dr. G.M. Dhole –Electric Power Distribution Automation –Laxmi Publications, Ltd.
4.	K S Manoj –Industrial Automation with SCADA: Concepts, Communications and Security Notion press 2019.
E-Resources	
1.	http://jjackson.eng.ua.edu/courses/ece485/lectures/
2.	https://electrical-guru.com/subject.aspx?id=3&code=6EE5A&unitid=3&topicid=18
3.	https://www.watelectrical.com/scada-applications-in-power-system/

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PS208	**Power System Simulation lab -II**	**0**	**0**	**3**	**2**	**60**	**40**	**100**
Course Objective	The students should made to • Analyze simulation results and effective documentation							

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1 : Analyze simulation results and effective documentation	K4
	CO2 :Exhibit professional behavior	K4
	CO3 :Acquire expertise in usage of modern tools	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**	**PSO 4**
CO 1	3	2				1							3		1	
CO 2	2	3	2						1				2		2	1
CO 3	3	2	2	2						1			3	2		
CO 4	3		2	3						1			2		1	1
CO 5		3	2	2					1					2		1

Direct
1. Pre lab &Post lab test 2. End-Semester examinations
Indirect
1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus

S.No	LIST OF EXPERIMENTS	Course Outcome	Program Outcome & Program Specific Outcome
1.	Load frequency dynamics of single and two area power system.	CO1	PO3,PO4,PO5, PSO2,PSO3
2.	Load flow analysis of a given power system with STATCOM.	CO3	PO3,PO4,PO5, PSO1,PSO2,PSO3
3.	Simulation of facts controllers.	CO1	PO3,PO5 PSO2,PSO3
4.	Determination of power angle curve for non- salient pole synchronous machines.	CO1	PO3,PO4,PO5, PSO2,PSO3,PSO4
5.	Swing curve for sustained fault and critical clearing angle & time.	CO1	PO3,PO5, PSO2,PSO3
6.	Small signal stability analysis of multi-machine system.	CO3	PO3,PO5, PSO2,PSO3
7.	Transient analysis of single machine infinite bus (SMIB) system with STATCOM.	CO3	PO2,PO3,PO5, PSO2,PSO3
8.	Write a program for best first search.	CO1	PO2,PO3,PO5, PSO2,PSO4
9.	Study the electromagnetic transients in power systems.	CO2	PO3,PO5, PSO1,PSO4

Total period : 45

Signature of the BOS chairman, EEE

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

Programe	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**		Semester		**I**

Course Code	Course Name	Periods Per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE01	**Power System Planning and Reliability**	3	0	0	3	40	60	100

Course Objective

The students should made to

- Understand the concept of load forecasting, short term and long term planning and methodology of reactive power planning.
- Understand the generation system model and recursive relation for capacitive model building.
- Understand the loss of load probability and the nature of demand.
- Classify the risk, system and load point reliability indices.
- Calculate the equivalent transitional rates, cumulative probability and cumulative frequency.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Estimate the trend of power consumption by end user.	K6
	CO2: Perform efficient short term and long term planning of power system.	K5
	CO3: Apply suitable control techniques to meet the constraints of reactive power consumption.	K3
	CO4: Forecast the power requirement in the future and execute expansion plans.	K6
	CO5: Understand the fundamentals designs of distribution substations and transmission lines	K2

Pre-requisites: Power Systems Operation and Control

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	3	3		3	1						1	2			
CO 2	3				2							2	2	1		
CO 3	3		2						1			1	2		1	
CO 4	3	1										2	2			
CO 5	3											2	2			

Signature of the BOS chairman, EEE

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	**LOAD FORECASTING**	Periods	**9**

Objectives of forecasting – Load growth patterns and their importance in planning – Load forecasting. Based on discounted multiple regression techniques – Weather sensitive load forecasting – Determination of annual forecasting – Use of AL in load forecasting.

Unit - II	**GENERATION SYSTEM RELIABILITY ANALYSIS**	Periods	**9**

Probabilistic generation and load models – Determination of LOLP and expected values of demand not served – Determination of reliability of isolated and interconnected generation systems.

Unit – III	**TRANSMISSION SYSTEM RELIABILITY ANALYSIS**	Periods	**9**

Deterministic contingency analysis – Probabilistic load flow – Fuzzy load flow probabilistic transmission system
reliability analysis – Determination of reliability indices like LOLP and expected values of demand not served.

Unit - IV	**EXPANSION PLANNING**	Periods	**9**

Basic concepts on expansion planning – Procedure followed for integrate transmission system planning, current practices in India – Capacitor placement problem in transmission system and radial distributions system.

Unit – V	**DISTIBUTION SYSTEM PLANNING OVERVIEW**	Periods	**9**

Introduction, sub transmission lines and distribution substations – Design of primary and secondary system – Distribution system protection and coordination of protective devices.

Total Periods	**45**

Text Books

1.	J. Nagrath and D.P. Kothari: Power System Engineering 2/e, MGH. 2011
2.	C. L. Wadhwa: Electrical Power Systems, New age international Ltd. Third Edition 2009
3.	A. S. Pabla: Electrical Power System Planning, Mcmillan India Ltd. 2012

References

1.	Proceeding of work shop on ―Energy system planning & manufacturing‖, CI.
2.	Sullivan R.L., ―Power system planning‖, McGrawHill.Inc,. US 1997.
3.	Roy Billinton and Allan Ronald, ―Power System Reliability‖, Gardon & Breach, Newyork, 1970
4.	M. Tllic, F. Faliana and L. Fink: Power System Restructuring Engineering and Economics, Kulwar Academic Publisher. 2010
5.	L. L. Lie: Power System Restructuring and Deregulation, John Willey & Sons UK. 2001

E-Resources

1.	https://nptel.ac.in/courses/108102047/
2.	https://swayam.gov.in/nd1_noc19_ee62/
3.	https://www.classcentral.com/course/swayam-power-system-analysis-14243

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**					Semester	**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE02	**Analysis of Inverters**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Understand the distinct operation of various inverter circuits.
- Design the various type of inverter circuits and apply the circuits practical applications.
- Develop the various inverters in simulation and hardware.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Apply voltage control and harmonic reduction techniques in inverters	K3
	CO2: Develop control strategies for three phase voltage source inverters	K3
	CO3: Distinguish the modes of operation for current source inverters	K4
	CO4: Construct various types if multilevel inverters	K2
	CO5: Design resonant inverters for various applications	K6

Pre-requisites: Electronic devices and circuits, Power semiconductor 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**	**PSO 4**
CO 1	3	2	2										3		1	
CO 2			2	3	1								2		1	
CO 3	2	1		2									1	2		1
CO 4		2	1		2		2				2			1	2	
CO 5		1	2	2	3						2			2		2

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II &III
2. Assignment, Mini project, quiz, problem based learning
3. End-Semester examinations

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**SINGLE PHASE INVERTERS**	Periods	**9**

Introduction to self-commutated switches: MOSFET and IGBT – Principle of operation of half and full bridge inverters – Performance parameters – Voltage control of single phase inverters using various PWM techniques – various harmonic elimination techniques – forced commutated Thyristor inverters.

Signature of the BOS chairman, EEE

Unit - II	THREE PHASE VOLTAGE SOURCE INVERTERS	Periods	9
180 degree and 120 degree conduction mode inverters with star and delta connected loads – voltage control of three phase inverters: single, multi pulse, sinusoidal, space vector modulation techniques.			
Unit – III	**CURRENT SOURCE INVERTERS**	Periods	**9**
Operation of six-step thyristor inverter – inverter operation modes – load – commutated inverters – Auto sequential current source inverter (ASCI) – current pulsations – comparison of current source inverter and voltage source inverters.			
Unit - IV	**MULTILEVEL INVERTERS**	Periods	**9**
Multilevel concept – diode clamped – flying capacitor – cascade type multilevel inverters - Comparison of multilevel inverters - application of multilevel inverters			
Unit – V	**RESONANT INVERTERS**	Periods	**9**
Series and parallel resonant inverters - voltage control of resonant inverters – Class E resonant inverter – resonant DC – link inverters			
		Total Periods	**45**

Text Books	
1.	Rashid M.H., ―Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.
2.	M.D.Singh, K.B.Khanchandani, ―Power Electronics‖ , 2nd Edition Tata McGraw Hill Education,2008.
References	
1.	Jai P.Agrawal, ―Power Electronics Systems‖, Pearson Education, Second Edition, 2002.
2.	Bimal K.Bose ―Modern Power Electronics and AC Drives‖, Pearson Education, Second Edition, 2003.
3.	P.C.Sen, ―Power Electronics‖, 1st Edition, Tata McGraw Hill India, 2007.
4.	P.S. Bimbra, ―Power Electronics‖, Khanna Publishers, 2012, New Delhi.
5.	Ned Mohan, Tore M. Undeland, William P.Robbins, ―Power Electronics: Converters, Applications and Design‖, Wiley student education, Third Edition.
E-Resources	
1.	http://nptel.ac.in
2.	http://www.sciencedirect.com
3.	http://www.researchgate.net

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE03	**High Power Converters**	3	0	0	3	40	60	100

Course Objective

The student should be made to
- Understand the requirements of high power rated converters.
- Understand the different topologies involved for these converters
- Able to understand the design of protection circuits for these converters

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: To understand the working of commonly used AC-DC power Converters	K2
	CO2: To analyze of power semiconductor switched circuits with different loads	K3
	CO3: To analyze and design various DC-DC power converter systems.	K3
	CO4: Various Inverters will be analyzed.	K3
	CO5: AC-AC Converter will be analyzed	K3

Pre-requisites Power Electronics

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			3	3										2	2
CO 2	3				3										2	2
CO 3	3				3							3			2	2
CO 4	3								3						2	2
CO 5	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	**AC TO DC CONVERTERS**	Periods	**9**

Single-Phase and Three-Phase AC to DC converters-half controlled configurations- operating domains of three phase full converters and semi-converters – Reactive power considerations.

Signature of the BOS chairman, EEE

Unit - II	**POWER SEMICONDUCTOR SWITCHED CIRCUITS**	Periods	**9**
Analysis of power semiconductor switched circuits with R, L, RL, RC loads, d.c. motor load, battery charging circuit.			
Unit – III	**DC TO DC CONVERTERS**	Periods	**9**
Analysis and design of DC to DC converters- Control of DC-DC converters, Buck converters, Boost converters, Buck-Boost converters, Cuk converters			
Unit - IV	**INVERTERS**	Periods	**9**
Single phase and Three phase inverters, Voltage source and Current source inverters, Voltage control and harmonic minimization in inverters			
Unit – V	**AC TO AC POWER CONVERTER**	Periods	**9**
AC to AC power conversion using voltage regulators, choppers and cyclo-converters, consideration of harmonics, introduction to Matrix converters.			
		Total Periods	**45**

Text Books	
1.	High-Power Converters and AC Drives (IEEE Press Series on Power Engineering) 2nd Edition, Bin Wu (Author), Mehdi Narimani (Author), Publisher: Wiley-IEEE Press; 2 edition (January 17, 2017)
2.	RashidM.H.,_ Power Electronics-Circuits, Devices and Applications‘, Prentice Hall India, New Delhi, 2009.
3.	High–Power Converters and AC Drives, Bin Wu (Author), Publisher: Wiley-Blackwell (31 March 2006)
References	
1.	Ned Mohan, Undeland and Robbin, _Power Electronics: converters, Application and design‘, John Wiley and sons. Inc, Newyork, 2006.
2.	P.CSen., _Modern Power Electronics‘, Wheeler publishing Company, 1st Edition, New Delhi, 2005
3.	Modular Multilevel Converters: Analysis, Control, and Applications, Sixing Du ; Apparao Dekka ; Bin Wu ; Navid Zargari, Wiley-IEEE Press 2018
4.	Modern Power Electronics and AC Drives 1st Edition by Bimal K. Bose , Prentice Hall; 1 edition (October 22, 2001)
5.	Power Electronics: Converters, Applications, and Design 3rd Edition by Ned Mohan (Author), Tore M. Undeland (Author), William P. Robbins (Author), Wiley; 3 edition (October 10, 2002)
E-Resources	
1.	http://site.iugaza.edu.ps/malramlawi/files/RASHID_Power_Electronics_Handbook.pdf
2.	https://easyengineering.net/power-electronics-by-bimbhra/
3.	https://onlinelibrary.wiley.com/doi/book/10.1002/9781119156079

Signature of the BOS chairman, EEE

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

Programme	**M.E**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE04	**Analysis and computation of Electromagnetic transients in power systems**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Understand the various types of transients and its analysis in power system.
- Learn about modeling and computational aspects transients computation.
- Know the concepts of parameters and modeling of overhead lines.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Analyze the wave equation and its attenuation and distortions.	K3
CO2: Understand the over voltages due to lightning in power system and the transient over voltages.	K2
CO3: Explain the parameters in transmission lines and the effects of ground return and skin effect.	K2
CO4: Analyze the parameters of various underground cables and approximate the formulas for cable parameters.	K4
CO5: Illustrate the difficulties in transmission line parameters and the principle of digital computation of transients.	K5

Pre-requisites: Power System Operation and Control

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	2	2		1		1		1		1	3		3	2
CO 2	3	2	2	2		1		1		1		1	3		3	2
CO 3	3	2	2	2		1		1		1		1	3		3	2
CO 4	3	2	2	2		1		1		1		1	3		3	2
CO 5	3	2	2	2		1		1		1		1	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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**REVIEW OF TRAVELLING WAVE PHENOMENA**	Periods	**9**
Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.			
Unit - II	**LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES**	Periods	**9**
Lightning overvoltages: interaction between lightning and power system- ground wire voltage and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).			
Unit – III	**PARAMETERS AND MODELING OF OVERHEAD LINES**	Periods	**9**
Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on un transposed lines; effect of ground return and skin effect; transposition schemes			
Unit - IV	**PARAMETERS AND MODELING OF UNDERGROUND CABLES**	Periods	**9**
Distinguishing features of underground cables: technical features, electrical parameters, overhead lines versus underground cables; cable types; series impedance and shunt admittance of single-core self-contained cables, impedance and admittance matrices for three phase system formed by three single-core self-contained cables; approximate formulas for cable parameters.			
Unit – V	**COMPUTATION OF POWER SYSTEM TRANSIENTS**	Periods	**9**
Features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients .			
		Total Periods	**45**

Text Books	
1.	Allan Greenwood, ―Electrical Transients in Power System‖, Wiley & Sons Inc. New York,1991
2.	R. Ramanujam, ―Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation‖, I.K. International Publishing House Pvt. Ltd, New Delhi, 2014
Reference Books	
1.	Naidu M S and Kamaraju V, ―High Voltage Engineering‖, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004
2.	C.S.Indulkar,D.P.Kothari and K.Ramalingam,‖ Power System Transients A Statistical Approach‖, PHI Learning, Second Edition.
3.	Neville R. Watson and Jos Arrillaga,‖ Power Systems Electromagnetic Transients Simulation,IET Digital Library.
4.	Jaun A.Martinez-Velasco ,‖Transient Analysis of Power Systems : Solution Techniques, Tools and Applications‖,IEEE Express Willey.
5.	Allan Greenwood ,‖Electrical Transients in Power System‖,Wiley Student Edtion.
E- Resources	
1.	https://onlinelibrary.wiley.com
2.	http://www.ece.uidaho.edu/ee/power/ECE524/
3.	https://www.collectionscanada.gc.ca › vol2 › MWU › TC-MWU-30595

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE05	**Power Quality**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Understand the Power quality standards.
- Understand the Electrical power quality issues.
- Analysis of various PQ issues.
- Understand the Methods to improve power quality
- Understand the Reduction of PQ problems using custom power devices and harmonic filters.

Course Outcome	At the end of the course, the student should be able to,	**Knowledge Level**
	CO1: Understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.	K2
	CO2: Analyze the causes & Mitigation techniques of various PQ events. .	K3
	CO3: Understand the concepts about Voltage and current distortions, harmonics.	K3
	CO4: Analyze and design the passive filters.	K4
	CO5: Acquire knowledge on compensation techniques.	K5

Pre-requisites: Protection and switchgear

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	2	2	2	2		2	1			3	2	1	3		2	
CO 2	3	3	3	2						2	1		3		2	
CO 3	3	3		3		2					2	2	2	3	1	2
CO 4	3	3		3			2	2				2	2	3		2
CO 5		3	2		1			1				1		3		3

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**

Electric power quality phenomena- IEC and IEEE definitions – power quality disturbances-voltage fluctuations- transients-unbalance-waveform distortion-power frequency variations.

Signature of the BOS chairman, EEE

Unit – II	SAGS AND INTERRUPTIONS	Periods	9
Voltage variations, Voltage sags and short interruptions – flicker- longer duration variations – sources – range and impact on sensitive circuits-standards – solutions and mitigations – equipment and techniques.			
Unit – III	**TRANSIENTS AND PROTECTION**	Periods	**9**
Transients – origin and classifications – capacitor switching transient – lightning-load switching – impact on users – protection – mitigation.			
Unit – IV	**HARMONICS**	Periods	**9**
Harmonics – sources – definitions & standards – impacts – calculation and simulation – harmonic power flow – mitigation and control techniques – filtering – passive and active.			
Unit – V	**APPLICATIONS**	Periods	**9**
Power Quality conditioners – shunt and series compensators-D Statcom–Dynamic voltage restorer-unified power quality conditioners-case studies.			
		Total Periods	**45**

Text Books	
1.	Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, ―Electrical Power Systems Quality‖, McGraw Hill,2003.
2.	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,‖ Power Quality Problems & Mitigation Techniques‖ Wiley, 2015.
References	
1.	Heydt, G.T., ―Electric Power Quality‟, Stars in a Circle Publications, Indiana,2nd edition 1994.
2.	J. Arrillaga, N.R. Watson, S. Chen, ―Power System Quality Assessment‖, (New York: Wiley),2000.
3.	Math H.J.Bollen, ―Understanding Power Quality Problems: Voltage Sags and Interruptions‖, IEEE Press, New York, 2000.
4.	Arindam Ghosh ―Power Quality Enhancement Using Custom Power Devices‖, Kluwer Academic Publishers, 2002.
5.	Barry W.Kennedy: Power Quality Primer, McGraw-Hill, New York, 2000.
E-Resources	
1.	http://www.powerqualityworld.com/2011/09/handbook-power-quality-free-ebook.html
2.	http://www.idc-online.com/technical references/pdfs/electrical engineering/Types and Revolution of Electrical.pdf
3.	https://books.google.co.in/books/about/Electrical_Power_Quality_Control_Techniq.html?id=6xRfcCNvTiYC&redir_esc=y

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE06	**Power System Stability**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Learn the power system performance stability, the transient stability methods.
- Obtain the pareto-optimal solutions for small signal stability.
- Understand the basic knowledge about the dynamic mechanisms ,voltage stability problems and modeling issues
- Enhance the stability methods

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Interpret the fundamentals of power system stability and the modeling for excitation and Prime movers	K2
	CO2 :Analyze transient stability of power systems	K4
	CO3: Illustrate small signal stability analysis for single and multi machine system	K2
	CO4: Understand voltage stability problem and issues	K2
	CO5: Apply different methods to improve stability of power system	K3

Pre-requisites: Power system operation and control

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								1			3		1	
CO 2		3		2					1				2	1		
CO 3	3	2											3		2	
CO 4		2	1						1				2			
CO 5	1	3	2	2						1					2	1

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**POWER SYSTEM STABILITY CONSIDERATIONS**	Periods	**9**
Power system stability considerations – definitions-classification of stability - rotor angle and voltage stability - synchronous machine representation – classical model – load modeling concepts - modeling of excitation systems - modeling of prime movers.			
Unit - II	**TRANSIENT STABILITY**	Periods	**9**
Transient stability - swing equation-equal area criterion - solution of swing equation-Numerical methods - Euler method- Runge -Kutta method - critical clearing time and angle -effect of excitation system and governors- Multimachine stability – extended equal area criterion - transient energy function approach.			
Unit – III	**SMALL SIGNAL STABILITY**	Periods	**9**
Small signal stability – state space representation – eigen values - modal matrices – small signal stability of single machine infinite bus system – synchronous machine classical model representation - effect of field circuit dynamics - effect of excitation system-small signal stability of multi machine system			
Unit - IV	**VOLTAGE STABILITY**	Periods	**9**
Voltage stability – generation aspects - transmission system aspects – load aspects – PV curve – QV curve – PQ curve – analysis with static loads – load ability limit – sensitivity analysis - continuation power flow analysis - instability mechanisms – examples			
Unit – V	**METHODS OF IMPROVING STABILITY**	Periods	**9**
Methods of improving stability – transient stability enhancement – high speed fault clearing – steam turbine fast valving - high speed excitation systems- small signal stability enhancement-power system stabilizers – voltage stability enhancement – reactive power control			
		Total Periods	**45**

Text Books	
1.	Kundur, P., _Power System Stability and Control', McGraw-Hill International Editions, 1994
2.	Abhijit Chakrabarti, D.P. Kothari, A.K. Mukhopadhyay and Abhinandan De, _An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems', PHI Learning Private Ltd., 2010
References	
1.	Jai P.Agrawal, —Power Electronics Systems‖, Pearson Education, Second Edition, 2002.
2.	Anderson, P.M. and Fouad, A.A., „Power System Control and Stability", Galgotia Publications, New Delhi, 2003.
3.	Van Cutsem, T. and Vournas, C., _Voltage Stability of Electric Power Systems', Kluwer Academic Publishers, 1998.
4.	Prabha kundur, Power system stability and control, Mcgraw-Hill,Inc.
5.	P.M.Anderson, A.A.Fouad,‖Power System Control and Stability
E-Resources	
1.	https://ieeexplore.ieee.org/abstract/document/4503372
2.	https://www.electrical4u.com/transient-stability-and-swing-equation/
3.	http://www.engineeringenotes.com/electrical-engineering/power-system/improving-transient-stability-power-system-electrical-engineering/24809

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE07	**Electrical Power Distribution Systems**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Understand the distribution system expansion planning and reliability analysis procedures.
- Analyze the types of load and their characteristics.
- Understand the protection in distribution system.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Students will be able to do loss calculation in distribution lines , select the protective components, planning and reliability analysis	K2
	CO2: Differentiate the types of loads and their characteristics	K5
	CO3: Calculate the voltage drop and power loss in a distribution system.	K4
	CO4: Recognize the necessity of distribution system protection and devices available for discriminating faults	K5
	CO5: Design a suitable capacitance for voltage control in a distribution System	K6

Pre-requisites: Power System Analysis

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	2	1			3									2		
CO 2		1		2	1	1									2	
CO 3	1	1		2	1		1						1	1		
CO 4		3	2	1		2	2									
CO 5	1	2	2	1	2	1	1						1	1		

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**GENERAL CONCEPTS**	Periods	**9**
Industrial and commercial distribution systems – Energy losses in distribution system – system ground for safety and protection – comparison of O/H lines and underground cable system .Network model – power flow, short circuit and loss calculations.			
Unit - II	**DISTRIBUTION FEEDERS**	Periods	**9**
Distribution system, reliability analysis – reliability concepts – Markov model – distribution network reliability – reliability performance-			
Unit – III	**DISTRIBUTION PLANNING**	Periods	**9**
Distribution system expansion -planning – load characteristics – load forecasting – design concepts – optimal location of substation – design of radial lines – solution technique.			
Unit - IV	**SYSTEM ANALYSIS**	Periods	**9**
Voltage control – Application of shunt capacitance for loss reduction – Harmonics in the system – static VAR systems –loss reduction and voltage improvement.			
Unit – V	**PROTECTION**	Periods	**9**
System protection – requirement – fuses and section analyzers-over current. Under voltage and under frequency protection – coordination of protective device.			
		Total Periods	**45**

Text Books	
1.	Turan Gonen, ‒Electric Power Distribution Engineering‖,3rd Edition, CRC Press,2014
2.	James A. Momoh, Electric Power Distribution, Automation, Protection, and Control 1st Edition, CRC Press,2007
References	
1.	Pabla, A.S., „Electrical Power Distribution System‟, 5th edition,Tata McGraw hill, 2004.
2.	Tuvar Goner, „Electrical Power Distribution System Engineering‟, McGraw hill, 1986.
3.	Sterling, M.I.H., ‒Power System Control‖, Peter Peergisus, 2006
4.	Cooper, ‒Electrical Distribution System Protection‖1st edition, 2005
5.	Abdelhay A. Sallam ‒Electric Distribution Systems‖ 2nd edition, CRC Press, 2014
E-Resources	
1.	https://nptel.ac.in/courses/108107112/
2.	https://epdf.pub/electric-power-distribution-system-engineering.html
3.	http://tnebes.org/archive/2019/May19/safetymanual%20.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**		
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE08	**Power System Economics**	3	0	0	3	40	60	100

Course Objective	The students should made to • Understand the emissions of the polluting gases and to maintain the stability of the network after penetration of renewable energy. • Understand the economic efficiency of the production and use of electricity. • Promote efficiency and economy of the power system.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Identify the principles of power system planning, market/managerial economic aspects	K3
	CO2: Analyze the electricity power market	K4
	CO3: Identify the transmission congestion and pricing	K3
	CO4: Evaluate the reactive power and losses	K5
	CO5: Evaluate the power system economic planning ,Load forecasting and system reliability	K5
Pre-requisites	Generation of Electrical Energy	

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	2	2	2	2									2		2	2
CO 2	2	3	3										2		3	2
CO 3	3	2	2	2									2		2	3
CO 4	3	2	2	2									2		1	2
CO 5	3	2	2	2	2								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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**POWER SYSTEM RESTRUCTURING**	Periods	**9**
Market structure and operation- objective of market operation, electricity market models, power market types, market power, key components in market operation. Demand forecasting -Types, techniques. Costs: Short run –Long run- Relationship between short run and long run costs, perfect competition- Monopoly- Monopolistic and oligopolistic, Determination of market price, price discrimination.			
Unit – II	**ELECTRICITY PRICE**	Periods	**9**
Price volatility, ancillary services in electricity power market, automatic generation control and its pricing, generation assets valuation and risk analysis- Introduction, VAR for generation asset valuation , generation capacity valuation.			
Unit – III	**TRANSMISSION CONGESTION MANAGEMENT AND PRICING**	Periods	**9**
Transmission cost allocation methods, LMP, FTR and congestion Management.. Role of FACTS devices in competitive power market, available transfer capability, distributed generation in restructured markets.			
Unit – IV	**REACTUVE POWER MARKET MANAGEMENT**	Periods	**9**
Reactive power requirements under steady state voltage stability and dynamic voltage stability, reactive power requirements to covet transient voltage stability, system losses and loss reduction methods, power tariffs and market forces shaping of reactive power, reactive power requirement of the utilities.			
Unit – V	**GENERATION SYSTEM CHARACTERISTICS, COST AND RELIABILITY ANALYSIS**	Periods	**9**
Characteristic operation of power plants- choice of power plants- hydro, thermal and nuclear- size of plant- input/ output curves. Economic planning – generation system- cost analysis. Load forecasting and system reliability: load forecasting-generation system reliability – co-ordination methods- economic operation of power systems- simple problems.			
		Total Periods	**45**

Text Books	
1.	Daniel S. Kirschen, Goran Strbac, ‒Fundamentals of Power System Economics‖, 2Nd Edition
2.	Mohammad Shahidehpour, Hatim Yamin, Zuyi Li, **"**Market Operations in Electric Power Systems: Forecasting, Scheduling and Risk Management‖
References	
1.	Turner , wayne.C., ―energy management‖ hand book, 2nd edition.
2.	RR Barathwal- Professor IIT Kanpur. ― Industrial Economics- an introductory text book‖
3.	Steven Stoft,‖Power System Economics‖
E-Resources	
1.	https://www.taylorfrancis.com/books/9780429067532
2.	https://books.google.co.in/books/about/Fundamentals_of_Power_System_Economics.html?id=rm61AAAAIAAJ&redir_esc=y
3.	https://www.springer.com/gp/book/9783319723822

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester	**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE09	**Electric and Hybrid Vehicles**	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Understand the concept of fundamentals of electrical drives. • Analysis of electric vehicles. • Design of hybrid and electric vehicles with the HVDC converters and their control system.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand mathematical models, performance and characteristics of hybrid and electric vehicles.	K2
	CO2: Applying the concepts of topologies of power flow controllers.	K3
	CO3: Analyzing the concepts of hybrid vehicles of electric traction systems.	K4
	CO4: Design the concepts the configuration and control of various hybrid electric motor drives	K6
	CO5: Modeling and Plan and design appropriate vehicle management system.	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**	**PSO 4**
CO 1	3	3	3		1			1			2	2	2	1	1	1
CO 2	3	2	3		2			1			2	2	2	1	1	1
CO 3	3	3	3		2			1			2	3	2	1	1	1
CO 4	3	2	3		1			1			2	3	2	1	1	1
CO 5	3	3	3		1			1			2	3	2	1	1	1

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**

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Signature of the BOS chairman, EEE

Unit - II	TOPOLOGIES	Periods	9
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Basic concepts of electric traction, introduction to various electric drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.			
Unit – III	**ELECTRIC DRIVES**	Periods	**9**
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.			
Unit - IV	**ELECTRIC HYBRID VEHICLES**	Periods	**9**
Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems..			
Unit – V	**APPLICATIONS OF HYBRID VEHICLES**	Periods	**9**
Introduction to energy management strategies used in hybrid and electric vehicle, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy strategies.			
		Total Periods	**45**

Text Books	
1.	Bimal Bose, _Power electronics and motor drives‘, Elsevier, 2006
2.	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, 3rd Edition ,Kambish Ebrahim
References	
1.	Sira -Ramirez, R. Silva Ortigoza, _Control Design Techniques in Power Electronics Devices‘, Springer,2006
2.	Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, _Sliding mode control of switching Power Converters‘, CRC Press, 2011
3.	Ion Boldea and S.A Nasar, _Electric drives‘, CRC Press, 2005
4.	Electric and Hybrid Vehicles: Design Fundamentals, Second Edition,Iqbal husain
5.	Vehicular Electric Power Systems: Land, Sea, Air, and Space Vehicles (Power Engineering (Willis)),Ali Emadi
E-Resources	
1.	https://www.bharathuniv.ac.in/colleges1/downloads/courseware_eee/Notes/CE3/BEE033%20E&HV.pdf
2.	http://www.ieahev.org/about-the-technologies/hybrid-electric-vehicles/
3.	https://afdc.energy.gov/vehicles/how-do-hybrid-electric-cars-work

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester	**I**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE10	**Energy Management and Auditing**	3	0	0	3	40	60	100

Course Objective	The student should be able to • Comprehend energy management schemes and perform economic analysis and load management in electrical systems • Understand various energy conservation methods useful in a particular industry. • Select appropriate energy conservation method for the critical area identified.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Identify the demand supply gap of energy in Indian scenario	K2
	CO2: Carry out energy audit of an industry/Organization.	K5
	CO3: Formulate the energy flow diagram of an industry and identify the energy wasted or a waste stream.	K3
	CO4: Select appropriate energy conservation method to reduce the wastage of energy.	K6
	CO5: Evaluate the techno economic feasibility of the energy conservation technique adopted.	K6
Pre-requisites	Utilization of Electrical Energy	

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	1	1			3									2		
CO 2			2	1	1	2									3	
CO 3	1			1	2		1						1	1		
CO 4		3	2	1		1	3									
CO 5	1	3	2	1	2	1	1						1	1		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	**BASIC PRINCIPLES OF ENERGY AUDIT**	Periods	**9**

Energy audit- Definition, concept, type of audit, energy index, cost index, pie charts, sankey diagrams, load profiles, energy conservation schemes- energy audit of industries – energy saving potential, energy audit of process industry thermal power station and building.

Signature of the BOS chairman, EEE

Unit - II	ENERGY MANAGEMENT	Periods	9
Principles of energy management – Organizing energy management program , initiating, planning, controlling, promoting, monitoring, reporting –Energy manager, qualities and functions, language , questionnaire- Check list for top management.			
Unit – III	**ENERGY EFFICIENT MOTORS**	Periods	**9**
Energy efficient motors- Factors affecting deficiency, loss distribution, constructional details, characteristics – Variable speed, variable duty cycle systems, RMS hp – voltage variation- Voltage unbalance – Over motoring – Energy audit.			
Unit - IV	**POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS**	Periods	**9**
Power factor- Methods of improvement, location of capacitors, Power factor with non linear loads, effect of harmonics on PF motor controllers – Good lighting system – Design and practices, lighting control – Energy audit – Energy Instruments – Watt meter, data loggers, Thermocouples, pyrometers, lux meters, tongue testers.			
Unit – V	**ECONOMIC ASPECTS AND ANALYSIS**	Periods	**9**
Economic analysis – Depreciation Methods, time values of money, rate of return, present worth method, Replacement analysis, life cycle costing analysis – Energy efficient motors – Calculation of simple payback method, net present worth method – Power factor correction, lighting – Applications of life cycle cost analysis – Return on investment.			
		Total Periods	**45**

Text Books	
1.	Energy Management Supply and Conservation, Dr. Clive Beggs, Butterworth Heinemann, 2002 .
2.	Handbook of Energy Audits, Albert Thumann, Fairmont Press; 9th edition, 2012
References	
1.	Murphy W.R and G.Mckay Butter worth, ―Energy Management‖, Heinemann publications.
2.	Paul o Callaghan, ―Energy Management‖, Mc-Graw Hill Book Company – Ist edition; 1998.
3.	―Energy Management and Good Lighting Practice: fuel effeciency‖ – booklet 12 – EEO.
4.	Energy Management Handbook, Wayne C, John Willey and Sons
5.	Amlan Chakrabarti, Energy Engineering and Management, Prentice hall India 2011
E-Resources	
1.	https://nptel.ac.in/courses/108106022/
2.	http://www.npcindia.gov.in/competencies/energy-management/
3.	https://www.beeindia.gov.in/

Signature of the BOS chairman, EEE

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

Programme	**M.E**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE11	**Non Conventional Energy Systems**	3	0	0	3	40	60	100

Course Objective	The students should be made to • Aware of various forms of renewable energy • Understand in detail the wind energy conversion system and photo voltaic conversion system • Understand in detail about the energy storing techniques.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the concepts of solar cells and photovoltaic conversion and the applications of photo voltaic cells.	K2
	CO2: Describe the concepts of wind energy conversion systems and its applications.	K3
	CO3: Explain the operation of fuel cells and the application of Hydrogen Energy and thermo chemical methods.	K2
	CO4: Analyze the energy sources from tides and the applications of Energy storages	K4
	CO5: Describe the geothermal fossil systems and the applications of Geothermal Energy.	K3
Pre-requisites	Generation of Electrical Energy	

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	2	2		1		1		1		1	3		3	2
CO 2	3	2	2	2		1		1		1		1	3		3	2
CO 3	3	2	2	2		1		1		1		1	3		3	2
CO 4	3	2	2	2		1		1		1		1	3		3	2
CO 5	3	2	2	2		1		1		1		1	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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**SOLAR ENERGY**	Periods	**9**
Introduction to solar energy: solar radiation, availability, measurement and estimation – Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storages.			
Unit - II	**WIND ENERGY**	Periods	**9**
Introduction – Basic principles of wind energy conversion – wind data and energy estimation – site selection consideration – basic components of wind energy conversion system –Types of wind machines – basic components of wind electric conversion systems. Schemes for electric generations – generator control, load control, energy storage – applications of wind energy – Inter connected systems.			
Unit – III	**CHEMICAL ENERGY SOURCES**	Periods	**9**
Introduction – fuel cells – design and principles of operation of a fuel cell – classification of fuel cells. Types of fuel cells – conversion efficiency of fuel cells. Types of electrodes, work output and emf of fuel cell, Applications of fuel cells. Hydrogen energy: Introduction – hydrogen production – electrolysis, thermo chemical methods, Westing House Electro-chemical thermal sulphur cycle. Fossil fuel methods. Hydrogen storage, Utilization of hydrogen gas.			
Unit - IV	**ENERGY FROM OCEANS**	Periods	**9**
Introduction, ocean thermal electric conversion (OTEC), methods of ocean thermal electric power generation, open cycle OTEC system, closed OTEC cycle. Energy from tides: Basic principles of tidal power, component of tidal power plants, operation methods of utilization of tidal energy, site requirements, storage, advantages and limitations of tidal power generation. Ocean waves, energy and power from the waves, wave energy conversion devices.			
Unit – V	**GEOTHERMAL ENERGY**	Periods	**9**
Introduction, estimation of geothermal power, nature of geothermal fields, geothermal sources, inter connection of geothermal fossil systems, prime movers for geo thermal energy conversion. Application of geothermal energy. Energy from biomass: Introduction, Biomass conversion technologies, photosynthesis, classification of biogas plants. Biomass Energy conversion, Energy from waste.			
		Total Periods	**45**
Text Books			
1.	SP Sukatme, ―Solar Energy – Principles of thermal collection and storage, second edition, Tata McGrawHill, 1991.		
2.	J.A. Duffie and W.A. Beckman, ―Solar Engineering of Thermal Processes‖, Second Edition, John Wiley, New York, 1991.		
Reference Books			
1.	Chetan Singh Solanki, _Solar Photovoltaics -Fundamentals, Technologies and Applications‘, PHI Learning Pvt. Ltd., New Delhi, 2011		
2.	Van Overstraeton and Mertens R.P., _Physics, Technology and use of Photovoltaics‘, Adam Hilger, Bristol,1996.		
3.	John F.Walker& Jenkins. N , _Wind energy Technology‘, John Wiley and sons, Chichester, UK, 1997		
4.	Freries LL ,_Wind Energy Conversion Systems‘, Prentice Hall, U.K., 1990		
5.	D.P.Kothari,K.C.Singal and Rakesh Ranjan,‖Renewable Energy Sources and Emerging Technologies‖,Eastern Economy Edition, Second Edition		
E- Resources			
1.	https://nptel.ac.in/courses/108108078/		
2.	https://www.oreilly.com/library/view/non-conventional-energy/9789332579149/		
3.	http://bieap.gov.in/Pdf/Nonconventionalenergysourses.pdf		

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE12	**Fuzzy Systems**	3	0	0	3	40	60	100

Course Objective

The student should be made to,
- understand the basic concepts fuzzy logic
- Gain the knowledge in the fuzzy sets
- Gain insight on to the Neuro fuzzy modeling and control
- Apply the fuzzy concepts in the real time problems

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: know the basics of the Fuzzy logic system	K2
	CO2: Apply and analyze fuzzy sets for existing systems	K4
	CO3: To Develop a Fuzzy expert system and give the solution to the indiscriminate problems	K3
	CO4: learn and compare with the other soft computing models	K2
	CO5: Provide the solution to uncertain engineering applications	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		2								2	3	
CO 2	2	3	2	3	3								2	3	
CO 3	3	3	3	3	3									2	
CO 4	3	3	3	3	3									3	
CO 5	2		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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION TO FUZZY LOGIC PRINCIPLES**	Periods	**09**
Different faces of imprecision – inexactness, Ambiguity, Undecidability, Fuzziness and certainty, Probability and fuzzy logic, Intelligent systems.			
Unit – II	**CLASSICAL SETS AND FUZZY SETS**	Periods	**09**
Fuzzy sets and crisp sets - Intersections of Fuzzy sets, Union of Fuzzy sets, the complement of Fuzzy sets.			
Unit – III	**FUZZY ARITHMETIC**	Periods	**09**
Fuzzy reasoning - Linguistic variables, Fuzzy propositions, Fuzzy compositional rules of inference- Methods of decompositions, Defuzzification.			
Unit – IV	**NEURO-FUZZY DESIGN**	Periods	**09**
Methodology of fuzzy design - Direct & Indirect methods with single and multiple experts, Adaptive fuzzy control, Rule base design using dynamic response.			
Unit – V	**APPLICATION OF FUZZY SYSTEMS**	Periods	**09**
Fuzzy logic applications to engineering, Fuzzy decision making, Neuro-Fuzzy systems, Fuzzy Genetic Algorithms.			
		Total Periods	**45**

Text Books	
1	Zimmermann H. J., ‗Fuzzy set theory and its applications', Allied publishers limited, Madras, 4th Edition, 2001
2	Kwang H.Lee, ―First course on Fuzzy Theory and Applications‖, Springer–Verlag Berlin Heidelberg, 2005.
3	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2003.

References	
1	George J. Klir and bo yuan, ―fuzzy sets and fuzzy logic-theory and applications‖, prentice hall, 1995.
2	Klir G. J. and Folger T., ‗Fuzzy sets, uncertainty and information', Prentice Hall of India, New Delhi,1991.
3	EarlCox, ‗The Fuzzy Systems Handbook', AP professional Cambridge, 1999.
4	S.N.Sivanandam, S.Sumathi and S.N.Deepa, ―Introduction to Fuzzy Logic using MATLAB‖, Springer, 2007.
5	Bart Kosko, ―Neural Networks and Fuzzy Systems: Dynamical Systems Application to Machine Intelligence‖, Prentice Hall, 1992.

E-Resources	
1.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
2.	https://www.coursera.org
3.	https://www.lynda.com/course-tutorials

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE13	**Power Electronics for Renewable Energy**	3	0	0	3	50	50	100

Course Objective

The student should be made to,

- Study of environmental impacts of renewable energy systems.
- Obtain knowledge on role of electrical machines and power converters.
- Understand the concepts of WECS and hybrid RES.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Understand about renewable energy sources and their impacts	K2
CO2: Design analysis of Electrical Generators.	K3
CO3: Design of solar PV power converters.	K3
CO4: Analysis of speed variations in WECS.	K6
CO5: Design and analysis of hybrid systems.	K6

Pre-requisites: Power Electronics

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	3	3		3							2	2			
CO 2	3		2		2							2	2		2	
CO 3	3		2	2								2	2			
CO 4	3	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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**9**
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean,thermal Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.			
Unit - II	**ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION**	Periods	**9**
Review of reference theory fundamentals- principle of operation, analysis of induction generators (SCIG, DFIG) and synchronous generators (PMSG).			
Unit – III	**POWER CONVERTERS FOR RENEWABLE ENERGY**	Periods	**9**
Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters-selection of inverter, Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.			
Unit - IV	**ANALYSIS OF WIND AND PV SYSTEMS**	Periods	**9**
Stand alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, Solar: Block diagram of solar photo voltaic system -grid Integrated solar system.			
Unit – V	**HYBRID RENEWABLE ENERGY SYSTEMS**	Periods	**9**
Need for hybrid systems (wind-solar-diesel –fuel cell) –case studies – Maximum Power Point Tracking (MPPT) techniques for wind and solar..			
		Total Periods	**45**

Text Books	
1.	Mukund R.Patel, Wind and Solar Power Systems, CRC Press,2019
2.	Rai. G.D, –Non conventional energy sources‖, khanna publishers, 2004.
References	
1.	Gray, L.. Johnson, –Wind Energy System‖ , prentice hall line , 1995.
2.	Sumathi, S., Kumar, L. Ashok, Surekha, P. –Solar PV and Wind Energy Conversion Systems‖ Springer International Publishing Switzerland.2015
3.	S.M. Muyeen –Wind Energy Conversion Systems: Technology and Trends‖ Springer International Publishing Switzerland.2015
4.	Fouad A. S. Soliman –Solar-Wind Hybrid Renewable Energy for Sustainable Agriculture‖ LAP LAMBERT Academic Publishing October 2016.
5.	Dr.N.P.Subramanian―Renewable energy resources‖Lakshmi Publications, January 2013.
E-Resources	
1.	https://rmd.ac.in/dept/eee/sp/8/PERES/unit2.pdf
2.	https://www.powerelectronics.com/
3.	https://www.energy.gov/energysaver/grid-connected-renewable-energy-systems

Signature of the BOS chairman, EEE

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

Programme	**M.E**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE14	**Advanced Digital Signal Processing**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Course Objective

The students should made to
- Understand the concepts of stationary and non stationary random signals and analysis & characterization of discrete time random process
- enunciate the significance of estimation of power spectral density of random processors
- Understand the principles of optimum filters such as wiener and kalman filters
- Understand the principle of adaptive filters and their application to communication engineering
- Understand the concepts of multi-resolution analysis.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Articulate and apply the concepts of special random processes in practical application	K3
CO2: Choose appropriate spectrum estimation techniques for a given random process	K4
CO3: Apply optimum filters appropriately for a given communication application	K3
CO4: Apply appropriate adaptive algorithm for processing non-stationary signals	K3
CO5: Apply and analyze wavelet transforms for signal and image process based applications	K3

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**	**PSO 4**
CO 1	3	1		1	1									1	1	2
CO 2	3	2													2	1
CO 3	3	2	1											2	2	2
CO 4	2	2	1											3	2	2
CO 5	3	2		1	2									3	2	3

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

Indirect
1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**DISCRETE TIME SIGNALS, SYSTEMS AND THEIR REPRESENTATIONS**	Periods	**9**
Discrete time signals - Linear shift invariant systems - Stability and causality - Sampling of continuous time signals - Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier Transform - Z transform- Properties of different transforms			
Unit - II	**DISCRETE FOURIER TRANSFORM(DFT)**	Periods	**9**
Linear convolution using DFT - Computation of DFT Design of IIR digital filters from analog filters - Impulse invariance method - Bilinear transformation method.			
Unit – III	**DIGITAL FILTER DESIGN AND REALIZATION STRUCTURES**	Periods	**9**
FIR filter design using window functions - Comparison of IIR and FIR digital filters -Basic IIR and FIR filter realization structures - Signal flow graph representations Quantization process and errors - Coefficient quantization effects in IIR and FIR filters			
Unit - IV	**ANALYSIS OF FINITE WORD-LENGTH EFFECT**	Periods	**9**
A/D conversion noise- Arithmetic round-off errors- Dynamic range scaling-Overflow oscillations and zero Input limit cycles in IIR filters - Linear Signal Models			
Unit – V	**STATISTICAL SIGNAL PROCESSING**	Periods	**9**
All pole, All zero and Pole-zero models- Power spectrum estimation- Spectral analysis of deterministic signals - Estimation of power spectrum of stationary random signals - Optimum linear filters - Optimum signal estimation - Mean square error estimation - Optimum FIR and IIR Filters			
		Total Periods	**45**

Text Books	
1.	Sanjit K Mitra, ―Digital Signal Processing: A computer-based approach –,TataMc Grow-Hill Edition 1998
2.	Dimitris G .Manolakis, Vinay K. Ingle and Stephen M. Kogon, ―Statistical and Adaptive Signal Processing‖, Mc Grow Hill international editions .-2000
References	
1.	Jhon G.Proakis & Dimitrics G.Manolakis,‖Digital Signal Processing – principle ,algorthim,& Applications‖, Fourth Edition ,Person Education/Prentice Hall,2007.
2.	Sophoncies J.Orfanidis,‖Optimum Signal Processing‖, McGraw Hill,2000.
E-Resources	
1.	https://nptel.ac.in/courses/117101001/
2.	https://www-syscom.univ-mlv.fr/~zaidi/teaching/dsp-esipe-oc2/Course-Notes_Advanced-DSP.pdf
3.	https://lecturenotes.in/subject/362/advanced-digital-signal-processing-adsp

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN **(**Autonomous Institution Affiliated to Anna University, Chennai**)** Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE15	**Dynamics of Electrical Machines**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Course Objective

The students should made to

- Understand electrical machines and its characteristics
- Analyze the behavior of electrical machines under steady state and transient state
- Analyze the model of electrical machines under dynamic conditions

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Derive Kron's Primitive machine as an unified electrical machine model	K3
	CO2: Develop the mathematical model and control a 3- phase Induction motor	K6
	CO3: Analyze asymmetrical 2-phase induction motor	K4
	CO4:.Develope the mathematical model of DC motor and DC Series motor	K6
	CO5: Analyze a three phase synchronous machine under transient conditions	K4
Pre-requisites	Electrical Machines	

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	2		1										3	
CO 2	3	3	2		2										3	3
CO 3	3	2	2	2											3	
CO 4	3	3	1		2										3	
CO 5	3	2	1	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	**MODELING CONCEPTS**	Periods	**09**

Basic Two-pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bars and 3-ph induction machine, Kron's primitive machine.

Signature of the BOS chairman, EEE

Unit – II	**MODELING OF THREE PHASE INDUCTION MACHINE**	Periods	**09**
Generalized model in arbitrary reference frame- Electromagnetic torque – Derivation of commonly used induction machine models- Stator reference frame model Rotor reference frame model- Synchronously rotating frame model			
Unit – III	**SYMMETRICAL AND UNSYMMETRICAL 2 PHASE INDUCTION MACHINE**	Periods	**09**
Analysis of symmetrical 2 phase induction machine- voltage and torque equations in stationary reference frame variables for unsymmetrical 2 phase induction machine-analysis of steady state operation of unsymmetrical 2 phase induction machine			
Unit – IV	**DC MACHINE MODELING**	Periods	**09**
Mathematical model of a separately excited DC motor- steady state and transient analysis – Transfer function of a separately excited DC motor – Mathematical model of a DC series motor, shunt motor, linearization techniques for small perturbations.			
Unit – V	**DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINE**	Periods	**09**
Dynamic performance of synchronous machine, comparison of actual and approximate transient torque characteristics, Equal area criteria- simulation of three phase synchronous machine – modeling of PMSM.			
		Total Periods	**45**
Text Books			
1.	P.S. Bimbra, Generalised Theory of Electric Machines, Khanna Publications, 7thEdition, Delhi, 2010		
2.	Analysis of Electrical Machinery and drive systems- Paul C. Krause, OlegWasynczuk&Scott D. Sudhoff.2002		
REFERENCES			
1.	D.P. Sengupta & J.B. Lynn,‖ Electrical Machine Dynamics‖, The Macmillan Press Ltd. 1980		
2.	R Krishnan ―Electric Motor Drives, Modeling, Analysis, and Control‖, Pearson Education., 2001		
3.	P.C. Kraus, ―Analysis of Electrical Machines‖, McGraw Hill Book Company,1987		
4.	Chee Mun Ong ―Dynamic simulation of Electric machinery using Matlab / Simulink‖ – Prentice Hall 2003		
5.	C.V. Jones, ―The Unified Theory of Electrical Machines‖, Butterworth, London. 1967		
E-Resources			
1.	https://archive.org/ details/Dynamics_and_Control_of_Electrical_Drives/page/n3		
2.	https://epdf.pub/electrical-machines-drives-and-power-systems-sixth-edition-instructors-manual.html		
3.	https://nptel.ac.in/course.html		
4.	https://ocw.mit.edu/ans7870/resources/woodson/textbook/emd_part2.pdf		

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**II**
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE16	**SOFT COMPUTING TECHNIQUES**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Learn the Soft Computing Techniques to Improve Data Analysis Solutions.
- Perform cognitive functions as problem solving, expertise and intuition, to model complex systems
- Provide an exposure to genetic algorithm and knowledge on hybrid systems

At the end of the course, the student should be able to,	Knowledge Level
CO1: Understand the fundamentals and concepts of neural network systems	K2
CO2: Apply the concepts of neural network systems	K4
CO3: Describe fuzzy concept and fuzzy logic systems	K3
CO4 : develop the fuzzy logic systems	K2
CO5 : Understand the fundamentals and concepts of Genetic Algorithm.	K3

Pre-requisites: Fuzzy systems

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				1							3		1	
CO 2	2	3	2						1				2		2	1
CO 3	3	2	2	2						1			3	2		
CO 4	3		2	3						1			2		1	1
CO 5		3	2	2					1					2		1

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II &III
2. Assignment, Mini project, quiz, problem based learning
3. End-Semester examinations

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**ARTIFICIAL NEURAL NETWORKS**	Periods	**9**

Motivation for the development of neural networks- biological neural networks- artificial neural Networks – Fundamental Concepts - weights – biases and thresholds - common activation functions. McCulloch-Pitts neuron: Architecture, algorithm - Hebb Net- Architecture - algorithm – Perceptron –Architecture- algorithm- applications.

Signature of the BOS chairman, EEE

Unit - II	NEURAL NETWORK ARCHITECTURE AND ALGORITHMS	Periods	9
Back propagation Neural Net: Standard back propagation -architecture - algorithm - number of hidden layers - Discrete Hopfield neural net- architecture - algorithm ,Kohonen self-organizing Maps – Adaptive Resonance Theory-Basic architecture - Algorithm - Introduction to Neuro controllers.			
Unit – III	**FUZZY LOGIC**	Periods	**9**
Fuzzy sets - Properties of Classical and Fuzzy sets- Operations on Fuzzy sets- Fuzzy relations- Linguistic variables - Linguistic Hedges- Fuzzy statements- Assignment statements-Conditional statements- unconditional statements- Fuzzy rule base- Canonical rule formation-Decomposition of compound rules.			
Unit - IV	**FUZZY LOGIC CONTROLLER**	Periods	**9**
Fuzzy logic controller: Functional diagram - Fuzzification -Membership value assignments using intuition - Membership functions-Defuzzification: Max-Membership principle - centroid method – weighted average method.			
Unit – V	**GENETIC ALGORITHM**	Periods	**9**
Optimization – Traditional optimization methods – Concept of Evolutionary Algorithm – Genetic Algorithm – encoding and decoding of variables – GA operators – reproductions – Cross over – mutation – fitness function –fitness scaling. Advantages and limitations of GA, Applications of Genetic Algorithm. Introduction to hybrid systems –Genetic Neuro Hybrid Systems.			
		Total Periods	**45**

Text Books	
1.	Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
2.	Genetic Algorithms: Search and Optimization, E. Goldberg
References	
1.	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2003.
2.	H.Lee, ―First course on Fuzzy Theory and Applications‖, Springer–Verlag Berlin Heidelberg, 2005
3.	M. Ganesh - Introduction to fuzzy sets and fuzzy logic, PHI.
4.	Timothy J. Ross – Fuzzy logic with engineering applications, Wiley.
5.	Klir, G.J. & Yuan,B.- Fuzzy sets and Fuzzy logic, theory and applications, Prentice Hall of India Private Limited.
6.	J.S.R. Jang, C.T. Sun, E. Mizutani - Neuro-fuzzy and soft computing, PHI.
E-Resources	
1.	https://shodhganga.inflibnet.ac.in/bitstream/10603/34784/10/10_chapter1.pdf
2.	http://users.monash.edu/~app/CSE5301/Lnts/LaD.pdf
3.	http://users.du.se/~jwe/fuzzy/NFL/F9.PDF

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**

Course Code	Course Name	L	T	P	C	CA	ESE	Total
P19PSE17	**Computer Aided Power System Analysis**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Perform steady state and transient analyses of power system networks and also to explore the nuances of estimation of different states of power system.
- Emphasize the fundamentals of power system analysis while employing a computer for computational purpose for modeling and simulation of a system.
- Solve basis problems of AC Power flow analysis.
- Develop his own program for such purposes and feel more confident while using commercial software in the field.

Course Outcome

At the end of the course, the student should be able to,	Knowledge Level
CO1: Apply various numerical techniques, the role of sparsity and optimal ordering for performing various power system analyses.	K6
CO2: Analyze faulted power system for various types of faults and perform security and stability and analyzes.	K5
CO3: Evaluate the given power system about its operation using various analyses studied.	K3
CO4: Understanding the basics security analysis and contingency selection.	K6
CO5: Evaluate the transient stability and small signal stability of different power system Models.	K2

Pre-requisites: Power System Analysis

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

CO/PSO Mapping

COs	Programme Outcomes (POs)												PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	3	3	3		3	1						1	2			
CO 2	3				2							2	2	1		
CO 3	3		2						1			1	2		1	
CO 4	3	1										2	2			
CO 5	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

Signature of the BOS chairman, EEE

Content of the syllabus

Unit – I	**GENERAL INTRODUCTION**	Periods	**9**
Modern power systems operation and control – Different types of power system analyses – sparsity – Directed optimal ordering schemes – Solution algorithms – LU factorization – By factorization and iterative methods.			
Unit - II	**AC POWER FLOW ANALYSIS**	Periods	**9**
Introduction – Modeling of power system components – power flow equations – Formation of Y-bus matrix – power flow solution algorithm – Newton Raphson load flow method – fast decouple load flow method and DC load flow method – AC-DC system power flow analysis – Incorporating load models and FACTS devices in power flow algorithm – Incorporating HVDC converter control in power flow – Sequential and Simultaneous Solution Algorithms.			
Unit – III	**ANALYSIS OF FAULTED POWER SYSTEM**	Periods	**9**
Introduction to fault analysis and types of faults in power systems – Symmetrical Components – Sequences networks – Analysis of symmetrical and asymmetrical faults using sequences networks – Bus impedence matrix formulation – Short circuits analysis of Large Power systems using Z-bus – Analysis of Open circuit faults.			
Unit - IV	**SECURITY ANALYSIS**	Periods	**9**
Basic concepts – static Security Analysis at control centers – Contingency analysis – contingency selection.			
Unit – V	**STABILITY ANALYSIS**	Periods	**9**
Classification of power system stability – Classical model of synchronous machines and excitation system – Transient stability analysis of multi –machine systems – Eigen Analysis of dynamical systems – Small signal stability Analysis using classical model – Basics concepts of voltage stability analysis.			
		Total Periods	**45**

Text Books

1.	A. R. Bergen and V. Vittal, ―Power system analysis‖, Prentice Hall, 2000
2.	G.W. Stagg and A. H. El-Abiad, –Computer methods in power system analysis‖

References

1.	Elgerd O.I.,‖Electric Energy T heory – An Introduction‖,Second Edition.Tata McGraw-hill,2007
2.	Grainger J.J, and Stevenson W.D.,‖Power system analysis‖,McGraw-hill,Newyork,1994.
3.	L.P.Singh, ― Advanced power system analysis and dynamics‖, Wiley Eastern

E-Resources

1.	https://ieeexplore.ieee.org/document/6594487/
2.	https://www.degruyter.com/view/j/ijeeps?lang=en
3.	IET Journal on Generation, Transmission and Distribution.
4.	NPTEL Courses on Electrical Engineering.
5.	IEEE Transactions on Power System.

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**		
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester	**II**		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE18	**Modeling and Analysis of Electrical Machines**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Course Objective	The student should be made to, • Understand the various electrical parameters in mathematical form. • Understand the different types of reference frame theories and transformation relationships. • Analyze the electrical machine equivalent circuit parameters and modeling of electrical machines.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Outline about the various electrical parameters in mathematical form.	K4
	CO2: Recognize the difference frame theories for electrical machines	K2
	CO3: Analyze the steady state and dynamic state operation of DC machine	K3
	CO4: Modeling and analysis of Induction Machines	K3
	CO5: Analyze the steady state and dynamic state operation of synchronous machines	K3
Pre-requisites	Electrical machines	

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	1		3								2	1	2	2
CO 2	3				2								2			3
CO 3	3		2		2								2	2	3	3
CO 4	3	2			2								2	2	3	3
CO 5	3				2								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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION**	Periods	**09**
Basics field magnetic circuits – General expression of stored magnetic energy – Energy and Force/Torque equations – Singly and Doubly fed excited systems – Linear and Non – linear magnetic systems – Analysis of magnetic circuits with air gap and permanent magnets.			
Unit – II	**REFERENCE FRAME THEORY**	Periods	**09**
Static and rotating reference frames – Transformation of variables – Transformation between reference frames – Transformation of a balanced set – Balanced set – Balanced steady states phasor and voltage equations – Variables observed from several frames of references.			
Unit – III	**DC MACHINES**	Periods	**09**
Voltages and Torque Equations – Dynamics characteristics of permanent magnet and shunt DC Motors – State equations – Solution of dynamic characteristics by Laplace transformation.			
Unit – IV	**INDUCTION MACHINES**	Periods	**09**
Voltage and Torque Equations – Transformation for rotor circuits – Voltage and torque equations in reference frame variables – Analysis of steady state operation – Free acceleration characteristics – Dynamics performances for load and torque variations – Dynamic performance for three phase fault – Computer simulation in arbitrary reference frame.			
Unit – V	**SYNCHRONOUS MACHINES**	Periods	**09**
Voltage and Torque Equation – Voltage equation in arbitrary reference frame and rotor reference frame – Park equations – Rotor angle and angle between rotor – Steady state analysis – Dynamic performance for torque variations – Dynamic performances for three phase fault – Transient stability limit – Critical clearing time – Computer simulation.			
		Total Periods	**45**

Text Books	
1.	P S Bimbhra, ―Generalized Theory of Electrical Machines‖, Khanna Publishers, 2008
2.	A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umanx, ― Electric Machinery‖, Tata McGraw Hill, 5th Edition, 1992
References	
1.	Paul C.Krause.Oleg Wasyzczuk,Scott S.Sudhoff.‖Analysis of electric machinery and Drive Systems‖.Jhon Wiley&Sons, 2013.
2.	Krishan.R,‖Electric Motor Drives ,Modeling ,Analysis and control‖. Prentice Hall of India, 2002.
3.	Samuel Seely, ‖Electromechanical Energy Conversion‖, Tata McGraw Hill publishing Co,1962.
4.	Bimal K Bose, ―Modern Power Electronics and AC Drives‖, Prentice Hall of India, 2007, New Delhi
5.	Miller, T.J.E., ―Brushless Permanent Magnet and Reluctance motor types‖, Clarendon Press, 1st Edition, 1989
E-Resources	
1.	https://en.wikipedia.org/wiki/Electric_machine
2.	https://nptel.ac.in/courses/108106023/
3.	https://engineering.purdue.edu/~sudhoff/ee595s/reference%20frame%20theory.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester	**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE19	**Advanced Microcontroller Based Systems**	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Introduce the architecture of PIC microcontroller • Educate on use of interrupts and timers • Educate on the peripheral devices for data communication and transfer • Introduce the functional blocks of ARM processor • Educate on the architecture of ARM processors	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Develop an assembly language program using PIC controller.	K3
	CO2: Illustrate the concepts of interrupts and timer.	K2
	CO3: Apply the concept to interface with output devices.	K3
	CO4: Discover the concepts of ARM processor and assembly language programming.	K4
	CO5: Analyze and apply computing platform and software for engineering problems for various applications.	K4
Pre-requisites	Microprocessor & Microcontroller	

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										2			1
CO 2	3	3	2	1									2	1		
CO 3	3	2	2		2								1	2		
CO 4			2				2				1	1		2		1
CO 5			3	2	3	2				2	3	2			1	3

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II &III 2. Assignment, Mini project, quiz, problem based learning 3. End-Semester examinations
Indirect
1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION PIC MICROCONTROLLER**	Periods	**9**
Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx–- Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes –Simple Operations.			
Unit - II	**INTERRUPTS AND TIMER**	Periods	**9**
PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine – Timers Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.			
Unit – III	**PERIPHERALS AND INTERFACING**	Periods	**9**
I^2C Bus For Peripherals Chip Access– Bus Operation-Bus Subroutines– Serial EEPROM—Analog To Digital Converter–UART-Baud Rate Selection–Data Handling Circuit–Initialization - LCD And Keyboard Interfacing - ADC, DAC, And Sensor Interfacing.			
Unit - IV	**INTRODUCTION TO ARM PROCESSOR**	Periods	**9**
ARM Architecture –ARM programmer‘s model –ARM Development tools- Memory Hierarchy–ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.			
Unit – V	**ARM ORGANIZATION**	Periods	**9**
3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution, ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.			
		Total Periods	**45**

Text Books	
1.	Furber, S., ―ARM System on Chip Architecture‖ Addison Wesley trade Computer Publication, 2000.
2.	Peatman,J.B., ―Design with PIC Micro Controllers‖PearsonEducation,3rdEdition, 2004.
References	
1.	John.F.Wakerly: ―Microcomputer Architecture and Programming‖, John Wiley and Sons 1981.
2.	Ramesh S .Gaonker: ―Microprocessor Architecture, Programming and Applications with the 8085‖, Penram International Publishing (India), 1994.
3.	Raj Kamal: ―The Concepts and Features of Microcontrollers‖, Wheeler Publishing, 2005
4.	Mazidi, M.A.,―PIC Microcontroller‖ Rollin Mckinlay, Danny causey Printice Hall of India, 200
5.	Kenneth .J. Ayala, The 8051 Microcontroller, Architecture, Programming & Applications (third edition), Penram International, India (2004).
E-Resources	
1.	http://www.nxp.com/documents/data_sheet/LPC2141_42_44_46_48.pdf
2.	http://nptel.ac.in >courses
3.	http://easyengineering.net> microcontroller based system design

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester	**II**	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE20	**SCADA System and Applications**	3	0	0	3	40	60	100

Course Objective	The students should made to • Understand what is meant by SCADA and its functions. • Know SCADA communication. • Get an insight into its application.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Explain the basic building blocks of SCADA system	K2
	CO2: Describe the hardware and firmware requirements of SCADA Systems	K2
	CO3: Illustrate the role of PLC as RTU in SCADA system	K2
	CO4: Knowledge about single unified standard architecture IEC 61850.	K2
	CO5: Learn and understand about SCADA applications in transmission and distribution sector, industries etc	K2
Pre-requisites	Power system operation and control	

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	2										3	1	2	1
CO 2	3	3	2		2								2		2	
CO 3	3	3	2	2	2								2	3	2	2
CO 4	3	3	2		2								3		2	3
CO 5	3	3	2		2								2	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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**9**
Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies.			
Unit - II	**FUNCTIONS**	Periods	**9**
Monitoring and supervisory functions, SCADA applications in Utility Automation, SCADA in Industries.			
Unit – III	**SCADA UTILIZATION**	Periods	**9**
Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU),Intelligent Electronic Devices (IED), Programmable Logic Controller(PLC),Communication Network, SCADA Server, SCADA/HMI Systems			
Unit - IV	**ARCHITECTURE**	Periods	**9**
SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture –IEC 61850.			
Unit – V	**APPLICATIONS**	Periods	**9**
SCADA Communication: various industrial communication technologies-wired and wireless methods and fiber optics. open standard communication protocols. SCADA Applications: Utility applications-Transmission and Distribution sector-operations, monitoring, analysis and improvement. Industries - oil, gas and water. Case studies, Implementation, Simulation Exercises			
		Total Periods	**45**

Text Books	
1.	John W. Webb & Ronald A. Reis, ―Programmable Logic Controllers", Prentice Hall Publications, New Delhi, 2010.
2.	Dr. Mini Shaji Thomas –Power System SCADA and Smart Grids‖by CRC Press, Taylor and Francis, USA and a book chapter in the McGraw hill Standard Handbook of Electrical Engineers, 17th edition, 2018.
References	
1.	Stuart A. Boyer: ―SCADA-Supervisory Control and Data Acquisition‖, Instrument Society of AmericaPublications, USA,2004.
2.	Gordon Clarke, Deon Reynders: ―Practical Modern SCADA Protocols: DNP3, 60870.5 and RelatedSystems‖, Newnes Publications, Oxford, UK,2004.
3.	William T. Shaw, ―Cyber security for SCADA systems‖, PennWell Books, 2006.
4.	Kevin James, ―PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control‖, Newnes, 2000.
5.	Jane W. S. Liu, ―Real-time Systems‖, Pearson Education India, 2001.
E-Resources	
1.	https://nptel.ac.in/courses/108106022/
2.	https://nptel.ac.in/courses/108105063/
3.	https://www.kth.se/social/files/545950f7f27654434dcd3e53/Lecture+9+-+SCADA+Systems.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester		**II**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE21	**System Theory**	3	0	0	3	40	60	100

Course Objective	The students should made to • Learn the state space model for the given electrical/electromechanical systems. • Analyze the stability of the linear and nonlinear system. • Learn the concept of various advanced controllers.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Construct the state space model for the given electrical/electromechanical systems	K3
	CO2: Apply the concept of state and characteristic equations for SISO and MIMO systems	K3
	CO3: Construct the phase plane trajectory of a given non-linear systems	K3
	CO4: Evaluate the stability of the given linear and nonlinear system using Lyapunov stability theory	K5
	CO5: Evaluate the concept of various advanced controllers	K5
Pre-requisites	Control Systems	

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	2		3	
CO 2	3			2	2							2	2	2		
CO 3	3		3									2	2	2		
CO 4	3	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	**STATE VARIABLE REPRESENTATION**	Periods	**9**

Concepts of state, state variables and state model- State model for linear time invariant systems-State space representation using physical, phase and canonical variables – Transfer function from state model –Direct, cascade and parallel decomposition – Solution of state equation – State transition matrix

Signature of the BOS chairman, EEE

Unit – II	SYSTEM MODELS	Periods	9
Characteristic equation – Eigen values and eigen vectors – Invariance of eigen values – Diagonalization – Jordan canonical form –Concept of controllability and observability –Kalman's and Gilbert's tests – Controllable and Observable Phase Variable forms for SISO and MIMO systems – Effect of pole-zero cancellation on controllability and observability – Pole placement by state feedback –Full order and reduced order observers.			
Unit – III	**NONLINEAR SYSTEMS**	Periods	**9**
Types of nonlinearity – Phase plane analysis – Singular points – Limit cycles – Construction of phase trajectories – Describing function method – Derivation of describing functions			
Unit – IV	**STABILITY**	Periods	**9**
Introduction – Equilibrium Points – Stability in the sense of Lyapunov – BIBO Stability – Stability of LTI Systems – Equilibrium Stability of Nonlinear Continuous Time Autonomous Systems – Direct Method of Lyapunov – Linear Continuous Time Autonomous Systems – Finding Lyapunov Functions for Nonlinear Continuous Time Autonomous Systems – Krasovskii and variable – Gradient Method.			
Unit – V	**ADVANCED CONTROL SYSTEMS**	Periods	**9**
Adaptive Control: Model – Reference Adaptive Control – Fundamental concepts – Self tuning Control – Robust Control – Parameter perturbations – Design of robust control system – PID controllers – Fuzzy Logic Control – Neutral Network Controller – Genetic Algorithm			
		Total Periods	**45**

Text Books	
1.	M. Gopal, ―Modern Control System Theory‖, New Age International Publications, revised 2nd edition, 2005.
2.	K. Ogatta, ―Modern Control Engineering‖, PHI Publications, 2002.
References	
1.	I.J.Nagarath , M. Gopal, ―Control Systems Engineering‖, New Age International Publications, 4th edition, New Delhi, 2006.
2.	M.Gopal, ―Digital Control and state variable methods – conventional and intelligent control systems‖, Tata Mcgraw Hill 3rd edition, New Delhi, 2008.
3.	Stanley M. Shinners, ―Modern control system theory and design‖ Wiley-IEEE 2nd edition, 1998.
E-Resources	
1.	http://textbooks.opensuny.org/introduction-to-the-modeling-and-analysis-of-complex-systems/
2.	https://studentshubblog.files.wordpress.com/2014/12/modern-control-engineering-3rd-ed-ogataprentice-hall.pdf
3.	http://dl.icdst.org/pdfs/files/4fd6e5ae41a6b686d1f9bbb20de891f7.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN **(**Autonomous Institution Affiliated to Anna University, Chennai**)** Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE22	**AI Techniques**	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Introduce students to the basic concepts and techniques of Machine Learning. • To have a thorough understanding of the Supervised and Unsupervised learning techniques • To study the various linear and probability based learning techniques • Introduce the selection of features in the training and its dimensionality reduction • Analyze the applications AI and Machine Learning Techniques for various applications

	At the end of the course, the student should be able to,	Knowledge Level
Course Outcome	**CO1:** Use appropriate search algorithms for any AI problem	K2
	CO2: Represent a problem using first order and predicate logic	K3
	CO3: Apply the apt machine learning strategy for any given problem	K5
	CO4: Discriminate the learning algorithms for the applications	K4
	CO5: Design and applications for NLP that uses artificial intelligence	K6
Pre-Requisites	Discrete 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**	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	2	3	2		2								2	3		
CO 2	2	3	2	3	3								2	3		
CO 3	3	3	3	3	3									3		
CO 4	3	3	3	3	3									2		
CO 5	2		3		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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION OF AI AND PROBLEM SOLVING METHODS**	Periods	**09**
Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search.			
Unit – II	**KNOWLEDGE REPRESENTATION**	Periods	**09**
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information			
Unit – III	**MACHINE LEARNING AND LINEAR MODELS**	Periods	**09**
Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning. Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines. Probabilistic models - Self Organizing Feature Map.			
Unit – IV	**DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS**.	Periods	**09**
Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.			
Unit – V	**APPLICATIONS**	Periods	**09**
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – IKBS application in power system			
		Total Periods	**45**

Text Books	
1	Stuart J. Russell and Peter Norvig , ―Artificial Intelligence A Modern Approach‖, Third Edition, Prentice Hall 2010
2	I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3	Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
4	Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.
References	
1.	M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2.	Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3.	David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.
4.	Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
E-Resources	
1.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010
2.	https://www.coursera.org
3.	https://www.lynda.com/course-tutorials/Machine-Learning-AI-Foundations-Classification-Problems

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205.						
Programme	**M.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester	**II**	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE23	**Power Electronics Applications to Power Systems**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- Analyze and comprehend the various operating modes of wind electrical generators and solar energy systems.
- Analyze the power quality and faults.
- Analyze the different types of reactive power compensation schemes for converters

Course Outcome	At the end of the course, the student should be able to,	**Knowledge Level**
	CO1: Identify the suitability of exciting and new power electronics converter topologies for improving the performance of renewable energy system.	K2
	CO2: Understand the qualitative analysis of solar and wind energy sources.	K3
	CO3: Analyze the power system faults.	K3
	CO4: Design the relevant compensators for power quality problems based on appropriate power electronic converters.	K4

Pre-requisites	Power System and Power Electronics

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	3			2	1	1			3	2	1	2	3	2	
CO 2		3			3	2				2	1			3	3	
CO 3			2	2							2	2		3	1	3
CO 4			3	3			2	2				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**

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**POWER CONVERTERS FOR SOLAR SYSTEM**	Periods	**9**
Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.			
Unit – II	**POWER CONVERTERS FOR WIND SYSTEM**	Periods	**9**
Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Multi level Inverters-matrix converters.			
Unit – III	**WIND AND SOLAR PV ENERGY CONVERSION SYSTEMS**	Periods	**9**
Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS Grid Integrated solar system.			
Unit – IV	**POWER QUALITY AND FAULT ANALYSIS**	Periods	**9**
Impact of power electronics in power system – Harmonics – Flicker – Remedies – Fault behavior of wind and solar systems – International standards for grid integration of renewable energy sources.			
Unit – V	**SHUNT AND SERIES COMPENSATION**	Periods	**9**
Introduction, methods of VAR generation, analysis of uncompensated AC line, Passive reactive power compensation, Compensation by a series capacitor connected at the midpoint of the line, Effect on Power Transfer capacity, Compensation by STATCOM and SSSC, Fixed capacitor-Thyristor controlled reactor (FC-TCR), Thyristor-switched capacitor- Thyristor controlled reactor (TSC-TCR), static VAR compensators.			
		Total Periods	**45**

Text Books	
1.	Ned Mohan, Power Electronics Converters Applications and Design, New York, John Wiley and Sons, 2002.
2.	Ewald Fuchs, Mohammad A. S. Masoum, ―Power Quality in Power Systems and Electrical Machines‖, Academic Press, 2011.
References	
1.	S.N.Bhadra, D. Kastha, & S. Banerjee ―Wind Electrical Systems‖, Oxford University Press, 2009
2.	R.Sastrvedam,S.Sarma, ―Power quality VAR compensation in power systems‖,CRC Press 2009.
3.	Rakesh Das Bagamudres,‖Extra high voltage AC transmission Engineering‖,New age international ltd.,third edition 2007.
4.	Rai. G.D,‖ Solar energy utilization‖, Khanna publishes, 1993.
5.	Gray, L. Johnson, ―Wind energy system‖, prentice hall linc, 1995.
E-Resources	
1.	https://www.mdpi.com/journal/electronics/special_issues/appli_power_elec
2.	https://nptel.ac.in
3.	http://www.idc-online.com/technical references/pdfs/electrical engineering/Types and Revolution of Electrical.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN **(**Autonomous Institution Affiliated to Anna University, Chennai**)** Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE24	**Waste Management And Energy Recovery**	3	0	0	3	40	60	100

Course Objective

The student should be made to,

- Provide information on various methods of waste management.
- Understand recent energy generation techniques.
- Understand the recent technologies of waste disposal
- Realize on the importance of healthy environment

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand solid waste management techniques	K2
	CO2: Know what is biomass	K2
	CO3: Study Methods and factors considered for biomass gasification	K2
	CO4: Know equipment meant for biomass combustion	K1
	CO5: Understand about biogas and its development in India	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**	**PSO 4**
CO 1	3						3		2			2			2	2
CO 2	3						3					2			2	2
CO 3	3						3					2			2	2
CO 4	3						3		2			3			2	2
CO 5	3						3					2			2	2

Course Assessment Methods

Direct

4. Continuous Assessment Test I, II & III
5. Assignment
6. End-Semester examinations

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**09**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Signature of the BOS chairman, EEE

Unit – II	**BIOMASS PYROLYSIS**	Periods	**09**
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.			
Unit – III	**BIOMASS GASIFICATION**	Periods	**09**
Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.			
Unit – IV	**BIOMASS COMBUSTION**	Periods	**09**
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors			
Unit – V	**BIOGAS**	Periods	**09**
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India			
		Total Periods	**45**

Text Books	
1	Biomass for Energy, Industry and Environment, G. Grassi (Editor), A. Collina (Editor), H. Zibetta (Editor)6th E.C. Conference 1st Edition, Kindle Edition, CRC Press; 1 edition (April 21,
2	2014 Biomass as Energy Source: Resources, Systems and Applications,Erik Dahlquit,France Group,Londan,UK,2013
3	LaGrega,M., et al., –HazardousWasteManagement|,McGraw-Hill,c.1200 pp., 2nded.,2001.
REFERENCES	
1	Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.
2	Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991
3	Energy CogenerationHandbook,GeorgePolimveros, Industrial PressInc,NewYork1982
4	HowardS.Peavyetal,–Environmental Engineering|, McGrawHill International Edition,1985
E-Resources	
1	https://doi.org/10.1016/B978-0-12-410950-6.X5000-4
2	https://www.crcpress.com/Biomass-as-Energy-Source-Resources-Systems-and-Applications/Dahlquist/p/book/9781138073227#googlePreviewContainer
3.	https://www.sciencedirect.com/book/9780080428499/biomass-for-energy-and-the-environment#book-info

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE25	**Power Electronic Drives**	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Impart the knowledge of Steady state operation and transient dynamics of a motor load system. • Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively. • Analyze the operation of the AC motor drives	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Summarize the concepts of conventional DC drive	K2
	CO2: Analyze the performance of various semiconductor controlled DC drives and enhance uses of dc drive in modern applications.	K3
	CO3: Analyze the performance of AC motors with various control strategies	K3
	CO4: Implement of AC drive systems. .	K3
	CO5: Identify the suitability of control methods of AC Drives for industrial applications	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	3	2	-	2	-	-	-	-	-	-	-	-	2	1	
CO 2	-	3	2	2	-	-	-	-	-	-	-	-			1
CO 3	3	2	1	1	2	-	1	-	-	-	1	-	1		
CO 4	-	3	2	-	2	1	2	-	1	-	-	-		2	1
CO 5	3	3	2	1	-	-	-	1	-	-	2	-	1		2

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**RECTIFIER CONTROL OF DC DRIVES**	Periods	**9**
Review of Conventional Control of DC Drives and Characteristics - Methods of braking - Models and transfer function of series and separately excited dc motor–Multi quadrant operation. Control of dc drives with single phase and three phase converters- Closed loop control- Dual converter fed dc motor.			
Unit - II	**CHOPPER CONTROL OF DC DRIVES**	Periods	**9**
Chopper fed drives, input filter design. Step -up chopper for photovoltaic systems. Braking and speed reversal of DC motor drives using choppers, multiphase choppers, Closed loop control- Micro Computer implementation for drives.- Traction motors- Traction supply systems.			
Unit – III	**VOLTAGE AND FREQUENCY CONTROLLED INDUCTION MOTOR DRIVES**	Periods	**9**
Introduction - Four quadrant control and closed loop operation of AC drives – Effect of non-sinusoidal supply on performance of induction motor: Stator voltage control using AC voltage controller- VSI and CSI driven induction motors: motoring, regenerative braking and closed loop operation – Constant V/F control: Constant slip speed control and air gap flux weakening control – Comparison of VSI and CSI fed drives.			
Unit - IV	**ROTOR RESISTANCE CONTROL AND SLIP ENERGY RECOVERY SCHEMES**	Periods	**9**
Constant torque operation –static rotor resistance control – Principle of vector control – Direct vector control scheme – Indirect vector control scheme – Speed control of slip ring induction motor by injected emf- Torque slip characteristics – Static Kramer and Scherbius drives- sub synchronous and super synchronous operations- torque equation.			
Unit – V	**SYNCHRONOUS MOTOR DRIVES**	Periods	**9**
Vector controlled PM synchronous motor drives – constant flux and Flux weakening speed control - Power factor control and self-control - closed loop operation- permanent magnet synchronous motor (Brushless excitation) .			
		Total Periods	**45**

Text Books	
1.	Dubey G.K. "Power Semiconductor Controlled Drives", New York: Prentice Hall, 1993.
2.	Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003
References	
1.	P.C Sen, "Thyristor DC Drives", John wiley and sons, New York, 2001.
2.	R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt Ltd., New Delhi, 2003.
3.	VedamSubramanyam, "Electric drives concepts and applications", Tata McGraw Hill publishing company Ltd., II Edition, New Delhi, 2011.
E-Resources	
1.	http://nptel.ac.in/courses
2.	https://electrical–engineering-portal.com
3.	http://www.digimat.in>nptel>courses>video

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation			2019
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester			III
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE26	**Energy Conservation in Electrical Systems**	3	0	0	3	40	60	100
Course Objective	The student should be made to, • Understand the various types of energy storage. • Analyze the various applications of energy storage systems.							

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Analyze various types of energy storage devices and perform the selection based on techno-economic view point.	K4
	CO2: Understand the application of thermal storage system	K1
	CO3: Analyze the various types of batteries performance and its characteristics	K4
	CO4: Understand the concept of fuel cell and its application	K3
	CO5: Optimize the level of alternate energy storage technologies	K3
Pre-requisites	Power system modeling and analysis	

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	1		2	3											
CO 2	1	1	1	1	1										
CO 3	1		1	1	1										
CO 4	1		1	1	1										
CO 5	1		1	1											

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**09**
Necessity of energy storage – types of energy storage – comparison of energy storage technologies– Applications.			
Unit – II	**THERMAL STORAGE SYSTEM**	Periods	**09**
Thermal storage –Types–Modeling of thermal storage units– Simple water and rock bed storage system– pressurized water storage system– Modeling of phase change storage system– Simple units, packed bed storage units –Modeling using porous medium approach, Use of Transform			
Unit – III	**ELECTRICAL ENERGY STORAGE**	Periods	**09**
Fundamental concept of batteries–measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries–Lead Acid, Nickel– Cadmium, Zinc Manganese dioxide and modern batteries for example(i)zinc-Air(ii) Nickel Hydride, (iii)Lithium Battery.			
Unit – IV	**FUEL CELL**	Periods	**09**
Fuel Cell–History of Fuel cell, Principles of Electrochemical storage– Types–Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis– advantage and drawback of each type.			
Unit – V	**ALTERNATE ENERGY STORAGE TECHNOLOGIES**	Periods	**09**
Flywheel, Super capacitors, Principles &Methods–Applications, Compressed air Energy storage, Concept of Hybrid Storage–Applications			
		Total Periods	**45**

Text Books	
1.	IbrahimDincerandMarkA.Rosen,"ThermalEnergyStorageSystemsandApplications",John Wiley&Sons2002.
2.	James Larminie and Andrew Dicks, "Fuel cellsystemsExplained",Wileypublications,2003.
References	
1.	S. G. Jamdade, P. G. Jamdade) "Renewable Energy and Energy Storage" Tech-Neo Publications, LLP,2019
2.	Lunardini. V.J, Heat Transfer in Cold Climates, JohnWileyandSons1981.
E-Resources	
1.	https://energystorage.org/why-energy-storage/technologies/
2.	https://www.sciencedirect.com/topics/engineering/energy-storage-technology

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**B.E.**	Programme Code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
P19PSE27	**Industrial Load Modeling and Control**	3	0	0	3	40	60	100

Course Objective	The students should made to • Understand the energy demand scenario • Understand the modeling of load and its ease to study load demand industrially. • Impart knowledge in electricity pricing models	
Course Outcome	At the end of the course, the student should be able to,	**Knowledge Level**
	CO1: Acquire knowledge about energy scenario load management to reduce demand of electricity during peak time	K2
	CO2: Acquire knowledge about load control techniques in industries and its application.	K2
	CO3: Analyse and understand different energy saving opportunities in industries.	K2
	CO4: Acquire knowledge about reactive power control in industries and analyse different power factor improvement methods.	K2
	CO5: Learn mathematical modelling and profiling of various loads	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	1		2	3											
CO 2	1	1	1	1	1										
CO 3	1		1	1	1										
CO 4	1		1	1	1										
CO 5	1		1	1											

Course Assessment Methods

Direct

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

Indirect

1. Course - end Survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**ENERGY SCENARIO AND LOAD MANAGEMENT**	Periods	**9**
Electric Energy Scenario-Demand Side Management-Industrial Load Management-Load Curves-Load Shaping Objectives-Methodologies-Barriers-Classification of Industrial Loads-Continuous and Batch processes -Load Modeling.			
Unit - II	**LOAD MODELING AND PRICING**	Periods	**9**
Electricity pricing – Dynamic and spot pricing –Models-Direct load control- Interruptible load control- Bottom up approach- scheduling- Formulation of load models-Optimization and control algorithms - Case studies			
Unit – III	**INDUSTRIAL POWER MANAGEMENT**	Periods	**9**
Reactive power management in industries-controls-power quality impacts-application of Filters-Energy savings in industries			
Unit - IV	**LOAD CONTROL TECHNIQUES AND OPTIMIZATION**	Periods	**9**
Captive power units- Operating and control strategies- Power Pooling- Operation models; Energy Banking- Industrial Cogeneration; Selection of Schemes Optimal Operating Strategies-Peak load saving-Constraints-Problem formulation- Case study; Integrated Load management for Industries.			
Unit – V	**LOAD MODELING AND CONTROL**	Periods	**9**
Cooling and heating loads- load profiling- Modeling- Cool storage-Types-Control strategies-Optimal operation-Problem formulation- Case studies			
		Total Periods	**45**

Text Books	
1.	C.O. Bjork "Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands, 1989.
2.	C.W. Gellings and S.N. Talukdar,. Load management concepts. IEEE Press, New York, 1986
References	
1.	Richard E. Putman, industrial energy systems: analysis, optimization, and control, ASME Press, 2004
2.	Y. Manichaikul and F.C. Schweppe ," Physically based Industrial load", IEEE Trans. on PAS, April 1981
3.	I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering. , Tata McGraw Hill publishers, New Delhi, 2009.
4.	IEEE Bronze Book- .Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities., IEEE Inc, USA.
5.	Cogeneration as a means of pollution control and energy efficiency in Asia 2000. Guide book by UNESC for ASIA and the Pacific , Book No: ST/ESCAP/2026, UNESCAP, Bangkok
E-Resources	
1.	https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108101004/lec31.pdf
2.	https://www.researchgate.net/publication/312819368_Application_of_Demand_Side_Management_Techniques_in_SuccessiveOptimization Procedures
3.	https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/112105221/lec28.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**					Semester	**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE28	**Advanced Energy Storage Technologies**	3	0	0	3	40	60	100
Course Objective	The students should made to • Develop the ability to understand/ analyses the various types of energy storage. • Understand the various applications of energy storage systems.							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: Analyze various types of energy storage devices and perform the selection based on techno-economic view point.							K4
	CO2: Understand the application of thermal storage system							K1
	CO3: Analyze the various types of batteries performance and its characteristics							K4
	CO4: Understand the concept of fuel cell and its application							K1
	CO5: Optimize the level of alternate energy storage technologies							K4
Pre-requisites	Power system modelling and analysis							

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	1		2	3											
CO 2	1	1	1	1	2										
CO 3	1		1	2	2										
CO 4	1		1	2	2										
CO 5	1		1	2											

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**09**
Necessity of energy storage – types of energy storage – comparison of energy storage technologies– Applications.			
Unit – II	**THERMAL STORAGE SYSTEM**	Periods	**09**
Thermal storage –Types–Modeling of thermal storage units– Simple water and rock bed storage system– pressurized water storage system– Modeling of phase change storage system– Simple units, packed bed storage units –Modeling using porous medium approach, Use of Transform			
Unit – III	**ELECTRICAL ENERGY STORAGE**	Periods	**09**
Fundamental concept of batteries–measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries–Lead Acid, Nickel–Cadmium, Zinc Manganese dioxide and modern batteries for example(i)zinc-Air(ii) Nickel Hydride, (iii)Lithium Battery			
Unit – IV	**FUEL CELL**	Periods	**09**
Fuel Cell–History of Fuel cell, Principles of Electrochemical storage– Types–Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis– advantage and drawback of each type.			
Unit – V	**ALTERNATE ENERGY STORAGE TECHNOLOGIES**	Periods	**09**
Flywheel, Super capacitors, Principles &Methods–Applications, Compressed air Energy storage, Concept of Hybrid Storage–Applications			
		Total Periods	**45**

References	
1	IbrahimDincerandMarkA.Rosen,"ThermalEnergyStorageSystemsandApplications",John Wiley&Sons2002.
2.	James Larminie and Andrew Dicks, "Fuel cell systemsExplained",Wileypublications,2003.
3.	Lunardini. V.J, Heat Transfer in Cold Climates, JohnWileyandSons1981.
E-Resources	
1.	https://energystorage.org/why-energy-storage/technologies/
2.	https://www.sciencedirect.com/topics/engineering/energy-storage-technology

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE29	**POWER SYSTEM SECURITY**	3	0	0	3	40	60	100

Course Objective	The students should made to • Understand the characteristics of power system security • Understand the operations knowledge in power system security • Analyze the load forecasting and state estimation. • Analyze the methods in optimal power flow	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Assess the security level status of the large power system,	Understand
	CO2: Analyze the large power system in terms of real power performance index (PI) or other PIs	Analyze
	CO3: Identify the bad data in the measurement set, if present	Apply
	CO4: Estimate the state of the power system in terms of its measured values	Apply
	CO5: Optimize the power flow in terms of real and reactive power with the possible various objectives and constraints involved in energy management system	Apply
Pre-requisites	Power system modelling and analysis	

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	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3	PSO4
CO 1	1		2	3												
CO 2	1	1	1	1	2											
CO 3	1		1	2	2											
CO 4	1		1	2	2											
CO 5	1		1	2												

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**BASICS OF POWER SYSTEM SECURITY**	Periods	**9**
Introduction, Factors Affecting Power System Security, Contingency Analysis, Techniques for Contingency Evaluation DC Load Flow, Fast Decoupled Load-flow, Preventive and corrective Measures.An Overview of Security Analysis			
Unit – II	**OPERATIONS IN POWER SYSTEM SECURITY**	Periods	**9**
Linear Sensitivity Factors, Generation shift sensitivity factor, Line outage Distribution Factor, Line flow after outage, AC Power Flow Security Analysis, AC Power Flow Security Analysis With Contingency Case Selection, Concentric Relaxation, Bounding Area method.			
Unit – III	**LOAD FORECASTING & MEASEUREMENTS**	Periods	**9**
Estimation of average, periodic, stochastic components of load, basic idea of state estimation of power system. Detection and Identification of Bad Measurements, Network Observability and Psuedo-Measurements.			
Unit – IV	**STATE ESTIMATION**	Periods	**9**
Introduction, Method of Least Squares, Simple DC circuit example with suitable derivation, Maximum Likelihood Weighted Least-Squares Estimation, Matrix Formulation, Estimation formulae, State Estimation by Orthogonal Decomposition, The Orthogonal Decomposition Algorithm.			
Unit – V	**OPTIMAL POWER FLOW**	Periods	**9**
Introduction, Optimal Power Flow (OPF) Formulation, Economic Load Dispatch (ELD) problem formulation, Optimal Reactive Power Dispatch (ORPD), Economic Emission Dispatch (EED), Security Constrained OPF (SCOPF), OPF solution techniques, Lagrangian Multiplier Method, Linear Programming Method, Interior Point Method.			
Total Periods			**45**
Text Books			
1.	A.J.Wood and B.F. Wollenberg., Power generation, operation and control, John Wiley and sons, 1996.		
References			
1.	John J. Graignaer and William D. Stevenson, Power system analysis, Tata Mc Graw Hill, 2003.		
2.	P.Venkatesh, B.V.Manikandan, S.Charles raja and A.Srinivasan, ―Electrical power systems analysis, Security and Deregulation‖, PHI 2012.		

E-Resources	
1.	https://www.eeeguide.com/power-system-security/
2.	http://home.iitk.ac.in/~saikatc/

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**20**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester			**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSE30	**Smart Grid Technology and Applications**	3	0	0	3	40	60	100
Course Objective	The students should made to • Understand various aspects of smart grid. • Study various smart transmission and distribution technologies. • Impact knowledge in Computation intelligence Techniques, Algorithms • Familiarized with the high Performance computing for smart grid applications							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: Explain the Fundamentals Of Smart grids							K2
	CO2 :Describe the operation of smart grid components.							K2
	CO3: Assess the role of automation in Distribution							K3
	CO4: Apply computational techniques involved with the smart grid							K4
	CO5:Implement the smart grid technologies							K3
Pre-requisites	Smart grid							

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**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO3**	**PSO4**
CO 1	3		1			1										
CO 2	2	2	1	1	2											
CO 3	1		1	2		1	1									
CO 4	1	2	2	2	3	1										
CO 5	1		1	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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION TO SMART GRID**	Periods	**9**
Evolution of Electric Grid - Concept, Definitions and Need for Smart Grid - Smart grid drivers, functions, opportunities, challenges and benefits - Difference between conventional & Smart Grid - Concept of Resilient &Self Healing Grid - Present development & International policies in Smart Grid - Diverse perspectives from experts and global Smart Grid initiatives- Smart Grid Roadmap for India.			
Unit - II	**PMU, SAS and DAS**	Periods	**9**
Phasor Measurement Unit (PMU): Requirements, RTU limitations, GPS Time Synchronization, Location & Placement, Features – Wide Area Monitoring Systems (WAMS) – Sub-station Automation Systems (SAS) – Distribution Automation Systems (DAS), Introduction to Internet of things (IOT)- Applications of IOT in Smart Grid			
Unit – III	**DISTRIBUTION GENERATION TECHNOLOGIES**	Periods	**9**
Introduction to Renewable Energy Technologies –Micro grids – Storage Technologies –Electric Vehicles and plug – in hybrids –Environmental impact and Climate Change – Economic Issues. – Microgrid and Smart Grid Comparison**.**			
Unit – IV	**TOOLS AND TECHNIQUES FOR SMART GRID**	Periods	**9**
Computational Techniques – Static and Dynamic Optimization Techniques – Computational Intelligence Techniques – Evolutionary Algorithms – Artificial Intelligence techniques.			
Unit – V	**HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS**	Periods	**9**
Cluster Computing and Its Architecture - Basics of Cloud Computing - Cloud models (IaaS, SaaS, PaaS) - Public, private and hybrid clouds - Cloud Security for Smart Grid.			
		Total Periods	**45**

Text Books	
1	Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1e,2013
2	Gil Masters, Renewable and Efficient Electric Power System, Wiley–IEEE Press, 2e,2013
3	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama,―Smart Grid: Technology and Applications‖, Wiley & Sons Ltd., February 2012.
References	
1	Ali Keyhani and Muhammad Marwali, ―Smart Power Grids 2011, Springer Publications,2011.
2.	A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications",Springer Edition, 2e, 2017
3.	Vehbi C. Güngör, DilanSahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati,and Gerhard P. Hancke, Smart Grid Technologies: Communication Technologies and Standards IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011
4.	Christine Hertzog, ―Smart Grid Dictionary‖, Springer publications, 2009.
5.	T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e,2012.

E-Resources	
1	https://www.google.com/search?q=introduction+to+smart+grid&oq=introduction+to+smart+grid&aqs=chrome.0.69i59i0l7.6569j0j7&sourceid=chrome&ie=UTF-8
2	https://www.google.com/search?q=distribution+generation+technologies&oq=DISTRIBUTION+GENERATION+TECHNOLOGIES&aqs=chrome.0.0.1403j0j8&sourceid=chrome&ie= UTF-8
3	https://www.google.com/search?q=Wikipedia-smart+grid&oq=Wikipedia-smart+grid&aqs=chrome..69i57j0l3.10433j0j9&sourceid=chrome&ie=UTF-8

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E. & M.Tech**	Programme code	**204**	Regulation	**2019**			
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**			
Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC1	**Research Methodology and IPR**	2	0	0	0	100	-	100

Course Objective	The student should be made to, • Understand the importance of Research • Acquire knowledge in Data Collection • Acquire knowledge in Analysis of Data • Effectively write reports • Gain knowledge about publications	
Course Outcome	At the end of the course, the student should be able to,	**KL**
	CO1: Understand research problem types and data collection methods.	K2
	CO2: Understand research design methodologies	K2
	CO3: Analyze research related information	K4
	CO4: Follow research ethics	K3
	CO5: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	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**	**PSO 1**	**PSO 2**
CO 1	3	3	3	3	-	-	-	-	1	2	-	3	2
CO 2	3	3	3	3	-	-	-	-	1	2	-	2	2
CO 3	3	3	2	3	-	-	-	-	1	2	-	3	2
CO 4	3	3	3	2	-	-	-	-	1	2	-	1	1
CO 5	3	3	2	2	-	-	-	-	1	2	-	2	2

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II & III
2. Assignments

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit - I	**INTRODUCTION TO RESEARCH**	Periods	**9**
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research Meaning of Research- Types of Research- Research Process- Problem definition- Objectives of Research- Research design- Approaches to Research- Quantitative vs. Qualitative Approach- Research Methods versus Methodology -Research and Scientific Method-Research Process-Criteria of Good Research.			
Unit – II	**RESEARCH DESIGN**	Periods	**9**
Meaning of Research Design-Need for Research Design- Features of a Good Design-Important Concepts Relating to Research Design-Different Research Designs-Basic Principles of Experimental Designs			
Unit – III	**DATA COLLECTION**	Periods	**9**
Data Collection :Collection of Primary Data-Observation Method-Interview Method-Collection of Data through Questionnaires-Collection of Data through Schedules-Difference between Questionnaires and Schedules-Collection of Secondary Data- Processing Operations-Elements/Types of Analysis-Statistics in Research			
Unit – IV	**REPORT WRITING**	Periods	**9**
Report Writing: Meaning of Interpretation- Technique of Interpretation-Precaution in Interpretation-Significance of Report Writing-Different Steps in Writing Report-Layout of the Research Report-Types of Reports-Oral Presentation-Mechanics of Writing a Research Report-Precautions for Writing Research Reports			
Unit - V	**INTELLECTUAL PROPERTY RIGHTS (IPR)**	Periods	**9**
Nature of Intellectual Property: Patents, Designs, Trade and Copyright-IPR History-Patent Law—Trade Secret Law -Geographical Indications.			
		Total Periods	**45**

References	
1.	C. R. Kothari, "Research Methodology – Methods and Techniques", 2nd Edition, New Age International Publishers
2.	Bordens, K. S. and Abbott, B. B., "Research Design and Methods – A Process Approach", 8th Edition, McGraw-Hill, 2011
3.	Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
4.	Davis, M., Davis K., and Dunagan M., "Scientific Papers and Presentations", 3rd Edition, Elsevier Inc.
5.	Robert P. Merges, Peter S. Menell, Mark A. Lemley,"Intellectual Property in New Technological Age". Aspen Law & Business; 6 edition July 2012

E-Resources	
1.	https://www.questionpro.com/blog/research-design/
2.	https://research-methodology.net/research-methods/data-collection/
3.	https://www.wipo.int/edocs/pubdocs/en/intproperty/958/wipo_pub_958_3.pdf

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**			Semester	**I**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC2	**Pedagogy Studies**	2	0	0	0	100	0	100

Course Objective

The student should be made to,

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.	K2
	CO2: Understand the evidence on the effectiveness of these pedagogical practices, in what conditions, and population of learners.	K2
	CO3: Understand the teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	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**	**PSO 4**
CO 1							3					2	3			
CO 2							3					3	2			
CO 3							2					3	2			

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION AND METHODOLOGY**	Periods	**4**

Aims and rationale, Policy background, Conceptual framework and terminology- Theories of learning, Curriculum, Teacher education-Conceptual framework, Research questions**.-** Overview of methodology and Searching.

Signature of the BOS chairman, EEE

Unit - II	THEMATIC OVERVIEW	Periods	9
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries- Curriculum, Teacher education.			
Unit – III	EFFECTIVENESS OF PEDAGOGICAL PRACTICES	Periods	9
Evidence on the effectiveness of pedagogical practices- Methodology for the in depth stage: quality assessment of included studies- Teacher education (curriculum and practicum) and the school-curriculum and guidance materials best support effective pedagogy-Theory of change- Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies			
Unit - IV	PROFESSIONAL DEVELOPMENT	Periods	9
Alignment with classroom practices and follow up Support-Peer support-Support from the head teacher and the community- Curriculum and assessment- Barriers to learning: limited resources and large class sizes			
Unit – V	RESEARCH GAPS AND FUTURE DIRECTIONS	Periods	9
Research design - Contexts - Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.			
		Total Periods	**45**

References

1.	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2.	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3.	Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4.	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5.	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.Oxford and Boston: Blackwell.

E-Resources

1.	www.pratham.org/images/resource%20working%20paper%202.pdf.

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation		**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester			**I**
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC3	**Disaster Management**	2	0	0	0	100	0	100

Course Objective	The student should be made to, • Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response. • Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. • Understand the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. • Understand the strengths and weaknesses of disaster management approaches, • planning and programming in different countries, particularly their home country or the countries they work in	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.	K2
	CO2: Understand the evidence on the effectiveness of these pedagogical practices, in what conditions, and population of learners.	K2
	CO3: Understand the teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	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**	**PSO 4**
CO 1							3					3	2			
CO 2							3					3	3			
CO 3							3					2	3			

Course Assessment Methods

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

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**4**
Disaster: Definition, Factors And Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.			
Unit - II	**REPERCUSSIONS OF DISASTERS AND HAZARDS**	Periods	**9**
Economic Damage, Loss of Human And Animal Life, Destruction Of Ecosystem-Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.			
Unit – III	**DISASTER PRONE AREAS IN INDIA**	Periods	9
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides and Avalanches; Areas Prone to Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics			
Unit - IV	**DISASTER PREPAREDNESS AND MANAGEMENT**	Periods	9
Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application Of Remote Sensing, Data From Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.			
Unit – V	**RISK ASSESSMENT**	Periods	9
Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques Of Risk assessment, Global Co-Operation In Risk Assessment and Warning, People's Participation In Risk Assessment. Strategies for Survival.			
		Total Periods	**45**

References	
1.	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company.
2.	Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi.
3.	Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.
E-Resources	
1.	https://www.undp.org/content/dam/india/docs/disaster_management_in_india.pdf

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation		**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester			**I**
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC4	**Value Education**	**2**	**0**	**0**	**0**	**100**	**0**	**100**

Course Objective

The student should be made to,

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Knowledge of self-development	K2
	CO2: Learn the importance of Human values	K2
	CO3: Developing the overall personality	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**	**PSO 4**
CO 1							3					2	1			
CO 2							3					2	2			
CO 3							3					3	2			

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	**INTRODUCTION**	Periods	**4**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

Signature of the BOS chairman, EEE

Unit - II	**IMPORTANCE OF CULTIVATION OF VALUES**	Periods	**9**
Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness-Honesty, Humanity. Power of faith, National Unity.□ Patriotism. Love for nature, Discipline.			
Unit – III	**PERSONALITY DEVELOPMENT**	Periods	9
Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.			
Unit - IV	**BEHAVIOR DEVELOPMENT**	Periods	9
True friendship.- Happiness Vs suffering, love for truth-Aware of self-destructive habits-□ Association and Cooperation- Doing best for saving nature.			
Unit – V	**CHARACTER AND COMPETENCE**	Periods	9
Self-management and Good health-Science of reincarnation- Equality, Nonviolence ,Humility, Role of Women- All religions and same message-Mind your Mind, Self-control- Honesty, Studying effectively.			
		Total Periods	**45**
References			
1.	Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi		
E-Resources			
1.	https://www.undp.org/content/dam/india/docs/disaster_management_in_india.pdf		

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code			**202**	Regulation		**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester			**II**
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC5	**Constitution of India**	**2**	**0**	**0**	**0**	**100**	**0**	**100**

Course Objective	The student should be made to, • Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. • To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism. • To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1:1.Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	K2
	CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2
	CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	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**	**PSO 4**
CO 1	3						3					3	3			
CO 2	3						3					3	3			
CO 3	3						3					3	3			

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**HISTORY OF MAKING OF THE INDIAN CONSTITUTION**	Periods	**9**
History Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution- Preamble, Salient Features.			
Unit - II	**CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES**	Periods	**9**
Fundamental Rights -Right to Equality -Right to Freedom -Right against Exploitation -Right to Freedom of Religion -Cultural and Educational Rights -Right to Constitutional Remedies -Directive Principles of State Policy -Fundamental Duties.			
Unit – III	**ORGANS OF GOVERNANCE**	Periods	9
Parliament -Composition -Qualifications and Disqualifications -Powers and Functions -Executive - resident -Governor -Council of Ministers -Judiciary, Appointment and Transfer of Judges, Qualifications -Powers and Functions.			
Unit - IV	**LOCAL ADMINISTRATION**	Periods	9
District's Administration head: Role and Importance, -Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation-Pachayatiraj: Introduction, PRI: ZilaPachayat-Elected officials and their roles, CEO ZilaPachayat: Position and role -Block level: Organizational Hierarchy (Different departments), -Village level: Role of Elected and Appointed officials, -Importance of grass root democracy			
Unit – V	**ELECTION COMMISSION**	Periods	9
Election Commission: Role and Functioning - Chief Election Commissioner and Election – Commissioners - State Election Commission: Role and Functioning -Institute and Bodies for the welfare of SC/ST/OBC and women.			
		Total Periods	**45**
References			
1.	The Constitution of India, 1950 (Bare Act), Government Publication.		
2.	Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.		
3.	M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.		
4.	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.		
5.	Granville Austin"The Indian Constitution: Cornerstone of a Nation" Oxford University Press, 2002.		
E-Resources			
1.	https://www.loc.gov › law › help › guide › nations › India		

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205						
Programme	**M.E**	Programme code		**202**	Regulation	**2019**	
Department	**POWER SYSTEMS ENGINEERING /ELECTRICALAND ELECTRONICS ENGINEERING**			Semester		**II**	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC6	**English for Research Paper Writing**	2	0	0	0	100	-	100

Course Objective

The student should be made to,

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand forming and brake up sentences	K3
	CO2: Analyze and finding plagiarism solving and problem Finding	K2
	CO3: To explain the idea of literature review	K3
	CO4: Focus on skill development activities	K6
	CO5: To explain the concept of writing skills and development.	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			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1		3	2		2	3	3	2	3	1	3	2	3
CO 2	2	2	1	2	3	3	2	2	2	1	1	3	1	3	1	1
CO 3	3	3	1	2	3	1	1				1	2	3	2	1	2
CO4	1	1	2	3	1	2	2	1			1	2	1	2	3	2
CO5	3	2	1	2	1	2	1				2	1		2		2

Course Assessment methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit - I	**Planning and Preparation**	Periods	**9**
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.			
Unit – II	**Clarifications**	Periods	**9**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.			
Unit – III	**Literature Review**	Periods	**9**
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.			
Unit – IV	**Skill Development - I**	Periods	**9**
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.			
Unit - V	**Skill Development - II**	Periods	**9**
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission			
		Total Periods	**45**

Text Books	
1.	Adrian Wallwork, English for Writing Research Papers, Springer US,2011
2.	Swales, J.and C. Feak. Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press, 2012.
References	
1.	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2.	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3.	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
4.	C. R. Kothari, "Research Methodology – Methods and Techniques", 2nd Edition, New Age International Publishers
5.	Bordens, K. S. and Abbott, B. B., "Research Design and Methods – A Process Approach", 8th Edition, McGraw-Hill, 2011
E-Resources	
1.	https://warwick.ac.uk/fac/soc/al/globalpad/openhouse/reseachskills/
2.	https://www.scribendi.com/links.en.html
3.	https://warwick.ac.uk/fac/soc/al/globalpad/openhouse/teachingskills/

Signature of the BOS chairman, EEE

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

Programme	**M.E.**	Programme Code	**202**	Regulation	**2019**
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**		Semester		**II**

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSAC7	**Personality Development Through Life Enlightenment Skills**	2	0	0	0	100	0	100

Course Objective

The student should be made to,

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.	K2
	CO2:The person who has studied Geeta will lead the nation and mankind to peace and prosperity.	K2
	CO3:Study of Neetishatakam will help in developing versatile personality of students.	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**	**PSO 4**
CO 1	3						3					3	3			
CO 2	3						3					3	3			
CO 3	3						3					3	3			

Signature of the BOS chairman, EEE

Content of the syllabus	
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) -Verses- 26,28,63,65 (virtue) – Verses - 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)Approach to day to day work and duties - Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48,Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,- Chapter 18-Verses 45, 46, 48. Statements of basic knowledge - Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 - Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personalit y of Role model. Shrimad BhagwadGeeta:Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63.	
Total Periods	**45**
References	
1.	"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2.	Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.
E-Resources	
1.	https://www.udemy.com/course/personality-development-holistic-all-round/

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSOE2	**INDUSTRIAL SAFETY**	3	0		3	40	60	100
Course Objective	The student should be made to, • Provide in depth knowledge in Principles of Environmental safety and its applications in various fields. • Provide the knowledge of air and water pollution and their control.							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: Summarize the concepts of stationary equipments.							K2
	CO2: Understand the functions and responsibility of maintenance department.							K3
	CO3: Understand the effect of corrosion and their prevention.							K3
	CO4: Analyze the fault in machines							K3
	CO5: Analyze the periodic and preventive maintenance in machines.							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	3	2	-	2	-	-	-	-	-	-	-	-	2	1	
CO 2	-	3	2	2	-	-	-	-	-	-	-	-			1
CO 3	3	2	1	1	2	-	1	-	-	-	1	-	1		
CO 4	-	3	2	-	2	1	2	-	1	-	-	-		2	1
CO 5	3	3	2	1	-	-	-	1	-	-	2	-	1		2

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**CONCEPT AND STATUTORY REQUIREMENT**	Periods	9
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.			
Unit – II	**FUNDAMENTALS OF MAINTENANCE ENGINEERING**	Periods	**9**
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance , Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.			
Unit – III	**WEAR AND CORROSION AND THEIR PREVENTION**	Periods	**9**
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v .Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.			
Unit – IV	**FAULT TRACING**	Periods	**9**
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications ,sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.			
Unit – V	**PERIODIC AND PREVENTIVE MAINTENANCE**	Periods	**9**
Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition ,need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.			
		Total Periods	**45**

References	
1.	Maintenance Engineering and Management, Venkataraman, PHI learning private limited, Fourth printing,2010.
2.	Introduction to Maintenance Engineering, Mohamed Ben-Daya, Udaykumar, D.N. Prabhakar Murthy, John Wiley & Sons Ltd,2016
3.	Corrosion Prevention and Protection, V.S. Sastri, Edward Ghali, Mimoun Elboujdaini, John Wiley & Sons Ltd, 2006.
E-Resources	
1.	https://www.techspray.com/the-experts-guide-to-degreasers-maintenance-cleaners
2.	https://link.springer.com/chapter/10.1007/978-1-4615-5305-2_1
3.	https://www.fiixsoftware.com/maintenance-strategies/preventative-maintenance/

Signature of the BOS chairman, EEE

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University ,Chennai) Elayampalayam, Tiruchengode – 637 205							
Programme	**M.E.**	Programme Code		**202**	Regulation		**2019**	
Department	**POWER SYSTEMS ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING**				Semester		**III**	
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P19PSOE6	**Waste to Energy**	3	0	0	3	40	60	100
Course Objective	The student should be made to, • Understand the successful career in the energy industry; energy regulation and management agencies • Analyze the energy resources, technologies and management fundamentals, and capable in addressing the present and potential future energy problems. • Energy professionals, who are sensitive to, and well aware of, th energy issues and concerns.							
Course Outcome	At the end of the course, the student should be able to,							Knowledge Level
	CO1: Understood and acquired fundamental knowledge on the science of energy and on both the conventional and non-conventional energy technologies.							K2
	CO2: Acquired the expertise and skills needed for the energy monitoring, auditing and management							K3
	CO3: development, implementation, maintenance and auditing of Energy Management Systems.							K3
	CO4: Become capable of analysis and design of energy conversion systems.							K3
	CO5: Acquired skills in the scientific and technological communications.							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	3	2	-	2	-	-	-	-	-	-	-	-	2	1	
CO 2	-	3	2	2	-	-	-	-	-	-	-	-			1
CO 3	3	2	1	1	2	-	1	-	-	-	1	-	1		
CO 4	-	3	2	-	2	1	2	-	1	-	-	-		2	1
CO 5	3	3	2	1	-	-	-	1	-	-	2	-	1		2

Course Assessment Methods

Direct

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

Indirect

1. Course - end survey

Signature of the BOS chairman, EEE

Content of the syllabus			
Unit – I	**INTRODUCTION**	Periods	**09**
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors			
Unit – II	**BIO-MASS**	Periods	**09**
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.			
Unit – III	**BIO-METHANATION**	Periods	**09**
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.			
Unit – IV	**BIOMASS COMBUSTION**	Periods	**09**
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.			
Unit – V	**BIOGAS**	Periods	**09**
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.			
		Total Periods	**45**

REFERENCES	
1	Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2	Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, TataMcGraw Hill Publishing Co. Ltd., 1983.
3	Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
E-Resources	
1	https://www.sciencedirect.com/topics/engineering/waste-to-energy
2	https://www.eesi.org/papers/view/fact-sheet-biogasconverting-waste-to-energy

Signature of the BOS chairman, EEE