

**PART-I (M.Tech EEE)**  
**BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**REGULATIONS 2018**

**B-FACT: Bharath - Flexible Accommodative Choice based credit system for Technology**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**M.Tech – POWER SYSTEMS (FULL TIME)**

### **Vision**

The department of EEE constantly strives to provide excellent academic and research ambience for the students and members of the faculty of the department to inherit quality professional education of the international standard with skill for solving real life problems; to inculcate national/global perspective with human dignity and values; to imbibe leadership qualities; and to serve the societal needs at local / national / global levels.

### **Mission**

To provide a stimulating learning environment with a technological orientation to maximize the Individual potential by acquisition of high quality electrical and electronic engineering concepts through excellent practices in the latest and emerging technologies.

- DM1: To educate our students and provide them with the skills they need to meet high standards of excellence in Electrical and Electronics engineering.
- DM2: To prepare students for professional careers and advanced studies.
- DM3: To teach in and outside the classroom using traditional, innovative methods and pass along knowledge through basic and applied research in Electrical and Electronics Engineering.
- DM4: To Serve as a resource of Electrical and Electronics Engineering expertise at the regional, National and global levels.

### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

**PEO1:** To enable the students to have success of career in industry, research and teaching with fundamental and advanced knowledge and skills in power System engineering

**PEO2:** To innovate and contribute to solve engineering problems in the areas of, Power System Dynamics, Analysis, and Protection etc.

**PEO3:** To demonstrate collaborative professionalism and multi disciplinary approach with effective communication and managerial skills and provide acceptable solution for the real life problems in the field power System

### Mapping between Mission Vs PEOs

PEOs/ Missions	DM1	DM2	DM3	DM4
PEO1	✓	✓		
PEO2	✓	✓	✓	✓
PEO3	✓	✓	✓	✓

### PROGRAMME OUTCOMES (POs)

The post graduates are able to

**PO1.** Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in the area of power system with a global perspective.

**PO2.** An ability to use the appropriate techniques, skills, and modern tools necessary to Identify, formulate, and solve power system related problems

**PO3.** Ability to identify, formulate and carry out detailed investigation on multifaceted complex problems in area of Power Systems and envisage advanced research in thrust areas like FACTS, Smart Grid, Renewable energy resources etc.

**PO4.** An ability to work in a team to take up the challenges in the areas of Power System Dynamics, Analysis, and Protection etc and development support for the Power System infrastructure

**PO5.** An ability to carry out research and propose theoretical and practical methodologies to solve real time problems and maintain lifelong learning and research by involving various professional activities.

### **PROGRAMME SPECIFIC OUTCOMES**

**PSO 1.** Ability to design, experiment and analyze to improve power quality issues, optimize power usage, reduce power costs and increase safety, critical to energy intensive sectors such as industrial, commercial and power utilities.

**PSO 2.** To have Capacity to plan, design, operate, protect and use modern tools to provide appropriate solutions for the real time problems for promoting energy utilization, conservation, power system stability and sustainability

### **. MAPPING BETWEEN PROGRAMME EDUCATIONAL OBJECTIVES & PROGRAM OUTCOMES**

PEOs\POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
PEO1	✓	✓	✓	✓	✓	✓	✓
PEO2	✓	✓	✓	✓	✓	✓	✓
PEO3	✓	✓		✓	✓	✓	✓

## PART-II (M.Tech Power System)

### M.Tech – POWER SYSTEM

#### MAPPING BETWEEN COURSE & PROGRAM OUTCOMES(Semesterwise)

Mapping of Course with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
Sem	Courses\POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
	<b>THEORY</b>							
<b>I</b>	P18PCPS101 Power System Analysis	√	√	√		√	√	√
	P18PCPS102 Power System Dynamics-I	√		√		√		√
	P18PRPS101 Research Methodology for Electrical Engineers & IPR				√	√		√
	<b>PRACTICAL</b>							
	P18PCPS1L1 Power System Steady State Analysis Lab	√	√	√	√	√	√	√
	P18PCPS1L2 Power System Dynamics lab	√	√	√	√	√	√	√
	<b>THEORY</b>							
<b>II</b>	P18PCPS201 Digital Protection of Power System	√		√		√		
	P18PCPS202 Power System Dynamics-II	√		√		√		√
	<b>PRACTICAL</b>							
	P18PCPS2L1 Power System Protection Laboratory	√	√	√		√		√
	P18PCPS2L2 Advanced Power System Laboratory	√	√	√		√		√

	P18PRPS2P1 Mini Project With Seminar		√	√	√	√	√	√
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### PROFESSIONAL ELECTIVES

<b>Mapping of Course with Program outcomes (POs)</b> <b>(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low</b>								
	<b>Courses\POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PSO1</b>	<b>PSO2</b>
	P18PEPS011 Renewable Energy System	√	√	√	√	√	√	√
	P18PEPS012 High Power Converters	√	√	√	√	√		
	P18PEPS013 Wind And Solar Systems	√	√	√			√	
	P18PEPS014 Applied Mathematics	√		√		√	√	√
	P18PEPS021 Electric Power Distribution System	√	√	√	√	√	√	√
	P18PEPS022 Optimization Techniques in Power System					√	√	√
	P18PEPS023 Pulse Width Modulation For PE Converters	√	√	√		√		
	P18PEPS024 Electric And Hybrid Vehicles	√	√	√			√	-
	P18PEPS031 Restructured Power Systems	√		√				
	P18PEPS032 Smart Grids		√				√	√
	P18PEPS033 Dynamics OfElectrical Machines	√	√	√			√	√

	P18PEPS034 Power Apparatus Design	√	√	√		√	√	
	P18PEPS041 Advanced Micro-Controller Based Systems	√	√	√	√	√	√	√
	P18PEPS042 SCADA System And Applications	√			√	√	√	
	P18PEPS043 Power Quality	√	√	√			√	-
	18PEPS44 Artificial Intelligence Techniques	√	√		√	√	√	√
	P18PEPS051 Power System Transients	√	√	√			√	√
	P18PEPS052 Facts and Custom Power Devices	√	√	√			√	-
	P18PEPS053 Industrial Load Modeling And Control	√	√	√	√		√	√
	P18PEPS054 Dynamics Of Linear Systems	√	√	√		√	√	√

**CURRICULUM AND SYLLABUS  
(R2018)  
CHOICE BASED CREDIT SYSTEM**

(Applicable to the batches admitted from July 2018)

**M.Tech – POWER SYSTEMS  
(FULL TIME)  
I – IV SEMESTERS**

<b>SEMESTER I</b>								
Sl. No.	Course Code	Category	Course Title	Contact Period	L	T	P	C
<b>THEORY</b>								
1.	P18PCPS101	PC	Power System Analysis	3	3	0	0	3
2.	P18PCPS102	PC	Power System Dynamics-I	3	3	0	0	3
3.		PE	Professional Elective - 1	3	3	0	0	3
4.		PE	Professional Elective - 2	3	3	0	0	3
5.	P18PRPS101	PR	Research Methodology for Electrical Engineers and IPR	2	2	0	0	2
6.		AC	Audit I	2	2	0	0	0
<b>PRACTICAL</b>								
7	P18PCPS1L1	PC	Power System Steady State Analysis Lab	4	0	0	4	2
8	P18PCPS1L2	PC	Power system Dynamics	4	0	0	4	2
Total				24	16	0	8	18

**SEMESTER II**

Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	P18PCPS201	PC	Digital Protection of Power System	3	3	0	0	3
2	P18PCPS202	PC	Power System Dynamics-II	3	3	0	0	3
3		PE	Professional Elective - 3	3	3	0	0	3
4		PE	Professional Elective - 4	3	3	0	0	3
5		AC	Audit II	2	2	0	0	0
<b>PRACTICAL</b>								
6	P18PCPS2L1	PC	Power System Protection Lab	4	0	0	4	2
7	P18PCPS2L2	PC	Advanced power system lab	4	0	0	4	2
8	P18PRPS2P1	PR	Mini Project with Seminar	4	0	0	4	2
Total				26	14	0	12	18

**SEMESTER III**

Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1		PE	Professional Elective - 5	3	3	0	0	3
2		OE	Open Elective	3	3	0	0	3
<b>PRACTICAL</b>								
3	P18PRPS3P2	PR	Phase – I Dissertation	20	0	0	20	10
Total				26	6	0	20	16

**SEMESTER IV**

Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
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1	P18PRPS4P3	PR	Phase-II Dissertation	32	0	0	32	16
Total				32	0	0	32	16

**TOTAL CREDIT : 18+18+16+16= 68**

### LIST OF ELECTIVES

<b>PROFESSIONAL ELECTIVE - 1</b>								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18PEPS011	PE	Renewable Energy System	3	3	0	0	3
2	P18PEPS012	PE	High Power Converters	3	3	0	0	3
3	P18PEPS013	PE	Wind and Solar Systems	3	3	0	0	3
4	P18PEPS014	PE	Applied mathematics	3	3	0	0	3
<b>PROFESSIONAL ELECTIVE - 2</b>								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18PEPS021	PE	Electrical Power Distribution System	3	3	0	0	3
2	P18PEPS022	PE	Optimization Technique in Power systems	3	3	0	0	3
3	P18PEPS023	PE	Pulse width modulation for PE Converters	3	3	0	0	3
4	P18PEPS024	PE	Electric and Hybrid Vehicles	3	3	0	0	3
<b>PROFESSIONAL ELECTIVE - 3</b>								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18PEPS031	PE	Restructured Power Systems	3	3	0	0	3
2	P18PEPS032	PE	Smart Grid	3	3	0	0	3
3	P18PEPS033	PE	Dynamics of Electrical Machines	3	3	0	0	3
4	P18PEPS034	PE	Power Apparatus Design	3	3	0	0	3

PROFESSIONAL ELECTIVE - 4								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18PEPS041	PE	Advanced Micro-Controller Based Systems	3	3	0	0	3
2	P18PEPS042	PE	SCADA System and Applications	3	3	0	0	3
3	P18PEPS043	PE	Power Quality	3	3	0	0	3
4	P18PEPS044	PE	Artificial Intelligent Techniques	3	3	0	0	3

PROFESSIONAL ELECTIVE - 5								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18PEPS051	PE	Power System Transients	3	3	0	0	3
2	P18PEPS052	PE	FACTS and Custom Power Devices	3	3	0	0	3
3	P18PEPS053	PE	Industrial Load Modelling and Control	3	3	0	0	3
4	P18PEPS054	PE	Dynamics Of Linear Systems	3	3	0	0	3

OPEN ELECTIVE								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18OEBA001	OE	Business Analytics	3	3	0	0	3
2	P18OEME002	OE	Industrial Safety	3	3	0	0	3
3	P18OEMA003	OE	Operations Research	3	3	0	0	3
4	P18OEBA004	OE	Cost Management of Engineering Projects	3	3	0	0	3
5	P18OEME005	OE	Composite Materials	3	3	0	0	3
6	P18OEEE006	OE	Waste to Energy	3	3	0	0	3

## Audit I & Audit II

Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
1	P18ACEN001	AC	English for Research Paper Writing	2	2	0	0	0
2	P18ACCE002	AC	Disaster Management	2	2	0	0	0
3	P18ACEN003	AC	Sanskrit for Technical Knowledge	2	2	0	0	0
4	P18ACBA004	AC	Value Education	2	2	0	0	0
5	P18ACLW005	AC	Constitution of India	2	2	0	0	0
6	P18ACBA006	AC	Pedagogy Studies	2	2	0	0	0
7	P18ACYO007	AC	Stress Management by Yoga	2	2	0	0	0
8	P18ACBA008	AC	Personality Development through Life Enlightenment Skills	2	2	0	0	0

### SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester				No. of Credit	% of credit
		I	II	III	IV		
1	Professional Core (PC)	10	10			20	29.41
2	Program Electives (PE)	6	6	3		15	22.05
3	Open Electives (OE)			3		3	4.41
4	Project+ Research methodology+seminar (PR)	2	2	10	16	30	44.12
5	Audit Course(AC)	0	0			--	--
	<b>Total Credit</b>	<b>18</b>	<b>18</b>	<b>16</b>	<b>16</b>	<b>68</b>	<b>100</b>
	<b>Total Contact Hour</b>	<b>24</b>	<b>26</b>	<b>26</b>	<b>32</b>		

<b>P18PCPS101</b>	<b>POWER SYSTEM ANALYSIS</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45			3	0	0	3
	Prerequisite – Basics Power System						
	Course Coordinator: Dr.V.Jayalakshmi Department: EEE						
<b>COURSE OBJECTIVES</b>							
Student will be able to: Study various methods of load flow and to analyze various types of faults, security, state estimation and stability in power system							
<b>COURSE OUTCOMES (COs)</b>							
Students will be able to:							
CO1	U	Understand the different methods of load flow study and its applications to power system.					
CO2	A	solve load flow problem and voltage stability issues					
CO3	An	Examine faults and interpret the result for designing the circuit and analyze Static network reduction and Dynamic network reduction					
CO4	E	Observe and investigate the power system state estimations					
CO5	C	Investigate the stability of the system and estimate closeness to voltage collapse and calculate PV curves using continuation power flow					

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	1	H		H	H	3
	CO2	H		H		H	H	2
	CO3	H	1			2	2	H
	CO4	H				H	H	2
	CO5	H	1	M		2	3	3
3	Category	PROFESSIONAL CORE (PC)						
4	Approval							

## SYLLABUS

### Unit 1: Load flow

**7 hours**

Load flow: Overview of Newton-Raphson, Gauss-Siedel, fast decoupled methods, convergence properties, sparsity techniques, handling Q-max violations in constant matrix, inclusion in frequency effects, AVR in load flow, handling of discrete variable in load flow.

### Unit 2: Fault Analysis

**7 hours**

Fault Analysis: Simultaneous faults, open circuit faults, generalized method of fault analysis. - Analysis of balanced and unbalanced three phase faults – fault calculations – Short Circuit faults

### Unit 3: Security Analysis

**8 hours**

Security Analysis: Security state diagram, contingency analysis, generator shift distribution factors, line outage distribution factor, multiple line outages, overload index ranking

**Unit4 :Power system Equivalents**

**8 hours**

Power System Equivalents: WARD REI.equivalents. Static network reduction Ward. REI (Radial, Equivalent, Independent). Dynamic network reduction. Heuristic approach. Modal analysis approach.

**Unit 5:State Estimation**

**8 hours**

State Estimation: power system state estimation- Sources of errors in measurement, Method of least squares, Virtual and Pseudo, Measurement, Observability, Tracking state estimation,WSL method, bad data correction.

**Unit 6:Voltage stability**

**7 hours**

Voltage Stability: Voltage collapse, P-V curve, multiple power flow solution, continuation power flow, optimal multiplies load flow, voltage collapse proximity indices.Formulation of optimal power flow-solution by Gradient method-Newton’s method.

**TEXT BOOK**

- J.J. Grainger &W.D.Stevenson, “Power system analysis ”, McGraw Hill ,2003
- A. R. Bergen & Vijay Vittal , “Power System Analysis” ,Pearson , 2000

**REFERENCES**

- L.P. Singh , “Advanced Power System Analysis and Dynamics”, New Age International, 2006
- G.L. Kusic, “Computer aided power system analysis” ,Prentice Hall India, 1986
- A.J. Wood, “ Power generation, operation and control” , John Wiley, 1994
- P.M. Anderson, “Faulted power system analysis” , IEEE Press , 1995

Course Coordinator

HOD

<b>P18PCPS102</b>	<b>POWER SYSTEM DYNAMICS-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Basics power system				
	Course coordinator: Dr.V. jayalakshmi: EEE				
<b>OBJECTIVES</b>					
Student will be able to:					
<ul style="list-style-type: none"> <li>•Study of system dynamics, transients and its physical interpretation</li> <li>•Development of mathematical models for load, synchronous machine and induction motor</li> </ul>					

<b>COURSE OUTCOMES (COs)</b> <b>Students will be able to:</b>		
CO1	U	Understand the modeling of synchronous machine in details
CO2	A	Demonstrate Voltage and current equations and formulation of State-space equations
CO3	An	Stability analysis with and without power system stabilizer (PSS)
CO4	E	Prediction of sub-transient and transient inductance and Time constants
CO5	C	Create a small signal model and dynamic modeling for Induction motor.

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H		H	3	H	2	H
	CO2	H	H		2		H	2
	CO3	H		H	2		1	H
	CO4	H			2	H	1	2
	CO5	H	H		3		H	2
3	Category	PROFESSIONAL CORE (PC)						
4	Approval							

## **SYLLABUS**

### **Unit 1:Synchronous Machines**

**8 hours**

Synchronous Machines: Per unit systems, Park's Transformation (modified) Flux-linkage equations.

### **Unit 2:Voltage and current equations**

**8 hours**

Voltage and current equations, Formulation of State-space equations, Equivalent circuit.

### **Unit 3: Transient**

**7 hours**

Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines.

### **Unit4: Small signal model**

**8 hours**

Small signal model: Introduction to frequency model.

### **Unit5: Excitation**

**8 hours**

Excitation systems and Philips-Heffronmodel, PSS Load modeling.

### **Unit6: Induction Motors**

**6 hours**

Modeling of Induction Motors, Prime mover controllers.

### **TEXT BOOK**

- P. M. Anderson & A. A. Fouad "Power System Control and Stability", Galgotia , New Delhi, 1981
- J Machowski, J Bialek& J. R W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997

### **REFERENCES**

- P.Kundur, "Power System Stability and Control", McGraw Hill Inc., 1994.

- E.W. Kimbark, “Power system stability”, Vol. I & III, John Wiley & Sons, New York 2002.

Course Coordinator

HOD

<b>P18PRPS101</b>	<b>RESEARCH METHODOLOGY FOR ELECTRICAL ENGINEERS AND IPR</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 30		2	0	0	2
	Pre requisite– Nil					
	Course Coordinator: Dr.T.R.Rangaswamy. Department: EEE					
<b>COURSE OBJECTIVES:</b> Student will understand research problem formulation and Analyze research related information						
<b>COURSE OUTCOMES (COs)</b> <b>Students will be able to:</b>						
CO1	U	To understand the scope and objective of research problems.				
CO2	A	Implement procedure for the effective literature studies approaches, Plagiarism, and research ethics,				
CO3	An	To outline Patent Rights, Licensing and transfer of technology and IPR				
CO4	E	Discriminate the process of Patenting and IPR				
CO5	C	Design effective technical writing to format the research proposal.				

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1		2	2	2	3	L	H
	CO2		2	3	L	3	L	H
	CO3		1	3	L	3	L	H
	CO4		1	2	L	3	L	H
	CO5		2	3	L	3	L	H
3	Category	PROJECT & RESEARCH (PR)						
4	Approval							

## **SYLLABUS**

### **Unit 1:**

**8 hours**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

### **Unit 2:**

**6 hours**

Effective literature studies approaches, analysis Plagiarism, Research ethics,

### **Unit 3:**

**6 hours**

Effective technical writing, how to write report, Paper enveloping a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

### **Unit 4:**

**8 hours**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

### **Unit 5:**

**8hours**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

### **Unit 6:**

**6hours**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

## **TEXT BOOK & REFERENCES**

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
- Mayall, "Industrial Design", McGraw Hill, 1992.
- Niebel, "Product Design", McGraw Hill, 1974.
- Asimov, "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Coordinator

HOD

<b>P18PCPS1L1</b>	<b>POWER SYSTEM STEADY STATE ANALYSIS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Basics Power System				
	Course Coordinator: Dr.V.Jayalakshmi Department: EEE				
<b>COURSE OBJECTIVES:</b>					
To allow students to practically verify several concepts and procedures learned in power system modeling and analysis.					
To carry out system studies using state of the art power systems analysis software to assess system operation in steady state and under faulted conditions.					

<b>COURSE OUTCOMES (COs)</b>		
Students will be able		
CO1	A	Demonstrate model for two area load frequency control and loading of Genetators
CO2	An	To analyze Transmission line parameters, Transient Stability and short circuit using MATLAB
CO3	E	To upraise the methodologies for Load Frequency Dynamics of Single Area Bus and Two Area Bus System
CO4	C	Design protection scheme for Generator & Transformer

### LIST OF EXPERIMENTS

<b>Mapping of Course Outcomes with Program outcomes (POs)</b>								
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	H	M	L	L	H	L
	CO2	H	H	M	L	L	H	L
	CO3	H	H	M	L	L	H	L
	CO4	H	H	M	L	L	H	L
3	Category	PROFESSIONAL CORE (PC)						
4	Approval							

1. Mat lab program to solve load flow studies
2. Mat lab program to find optimum loading of generators
3. Simulink model for two area load frequency control
4. Transient stability analysis
5. Short circuit analysis using mat lab program

6. load frequency dynamics of single area bus system
7. Load frequency dynamics of two area bus system
8. Analysis of transmission line parameters
9. Study of complete protection scheme for generator
10. Study of complete protection scheme for transformer.

Course Coordinator

HOD

<b>P18PCPS1L2</b>	<b>POWER SYSTEM DYNAMICS LAB</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 30			0	0	4	2
	Prerequisite – Basics of Power systems						
	Course Coordinator: Dr.V.Jayalakshmi			Department: EEE			
<b>OBJECTIVES:</b> To gain practical knowledge on transient analysis of synchronous machine, two-bus system, Harmonic Analysis, excitation systems along with case study.							
<b>COURSE OUTCOMES (COs)</b> Students will be able							
CO1	U	Analyze Transient of synchronous machine and two-bus system.					
CO2	A	To execute simulation of Small-signal stability analysis of single machine-infinite bus system					
CO3	An	Analyze Transient of synchronous machine and two-bus system.					
CO4	E	To Simulate and analyze excitation systems					
CO5	C	To design and simulate three phase rectifier					

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	H	M	L	L	H	L
	CO2	H	H	M	L	L	H	L
	CO3	H	H	M	L	L	H	L
	CO4	H	H	M	L	L	H	L
	CO5	H	H	M	L	L	M	L
3	Category	PROFESSIONAL CORE (PC)						
4	Approval							

### LIST OF EXPERIMENTS

1. Transient analysis of synchronous machine
2. Transient analysis of two-bus system.
3. Small-signal stability analysis of single machine-infinite bus system using classical machine mode
4. Induction motor starting analysis
5. Harmonic Analysis of a Three-Phase Rectifier
6. Simulation and analysis of excitation systems
7. Case study 1
8. Case study -2

Course Coordinator

HOD

## SEMESTER 2

<b>P18PCPS201</b>	<b>DIGITAL PROTECTION OF POWER SYSTEM</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45					3	0	0	3
	Prerequisite – Basics of Digital Electronics								
	Course Coordinator: Ms.S. Dhivya      Department: EEE								
<b>OBJECTIVES:</b>									
To get an overall idea of different types of static relays and its applications, and about the modern digital techniques used in power system protection.									

COURSE OUTCOMES (COs)		
CO1	U	To Understand the basic concept of digital protections and components
CO2	A	To discriminate various protection systems for Generator, Transformer and substations.
CO3	An	To identify various types of protection systems
CO4	E	Apprise all recent Advances in Digital Protection of Power Systems. Testing Digital of protection relays.
CO5	C	Design of digital relay as a unit consisting of hardware and software.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	2	3	2	2	1	L	3
	CO2	2	3	2	2	1	M	L
	CO3	H	3	2	2	M	H	L
	CO4	3	3	2	2	1	H	3
	CO5	3	3	2	3		H	3
3	Category	PROFESSIONAL CORE (PC)						
4	Approval							

### SYLLABUS

#### Unit 1:

**9 hours**

Evolution of digital relays from electromechanical relays, Performance and operational characteristics of digital protection. Hardware and software for the measurement of voltage, current, frequency and phase angle for digital protection

#### Unit 2:

**9 hours**

Mathematical background to protection algorithms: Finite difference techniques, Interpolation formulas: forward, backward and central difference interpolation, Numerical differentiation, Curve fitting and smoothing, Least squares method, Fourier analysis, Fourier series and Fourier transform, Walsh function analysis.

#### Unit 3:

**9 hours**

Digital Protection of power system apparatus –protection of generators – Transformer protection – magnetizing inrush current – Application and connection of transformer differential relays –

transformer over current protection. Bus bar protection, line protection, distance protection–long EHV line protection, Power line carrier protection

**Unit 4:**

**9 hours**

Basic elements of digital protection, Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing, Error, sample and hold circuits, multiplexers, analog to digital,conversion,Digital filtering concepts.

**Unit 5:**

**9 hours**

The digital relay as a unit consisting of hardware and software. Recent Advances in Digital Protection of Power Systems. Testing Digital of protection relays – digital data transmission - Concepts of modern coordinated control system

**TEXT BOOK**

1. Chakrabarti,M.L. Soni, P. V. Gupta, U. S. Bhatnagar “A text book on Power System Engineering”, DhanpatRai and Co.
2. Paithankar.Y.G and Bhide.S.R, “Fundamentals of Power System Protection”, Prentice-Hall of India. Badri Ram and Vishwakarma.
3. D.N, “Power System Protection and Switchgear”, Tata McGraw- Hill Publishing Company, 2002.
4. Arun K. Phadke, James. S. Thorp, “Computer relaying for Power system”, John Wiley and sons, New York, 1998.

**REFERENCES**

1. A.G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, Wiley/Research studies Press, 2009
2. A.T. Johns and S. K. Salman, “Digital Protection of Power Systems”, IEEE Press,1999
3. Gerhard Zeigler, “Numerical Distance Protection”, Siemens Publicis Corporate Publishing, 2006.S.R.Bhide “Digital Power System Protection” PHI Learning Pvt.Ltd.2014

CourseCoordinator

HOD

<b>P18PCPS202</b>	<b>POWER SYSTEM DYNAMICS -II</b>	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – <b>Power System Dynamics -I</b>				
	Course Coordinator: Ms.Dhivya      Department: EEE				
<b>COURSE OBJECTIVES:</b>					
The objective of the course is to provide an understanding of the advanced concept of dynamics and stability theory as applied to power system.					

COURSE OUTCOMES (COs)		
CO1	R	Recall the basic Concepts of Dynamic Systems and Stability definition
CO2	U	Understand the concept of voltage and frequency stability
CO3	A	Interpretation of power system dynamic phenomena.
CO4	An	Analyze the Asynchronous Operation and Re-synchronization, Multi-Machine Stability.
CO5	E	Defend the problem of factors affecting voltage instability and collapse.
CO6	C	Plan the methods to improve stability and automatic Generation Control.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	3	H		H	3	H
	CO2	H	H				H	2
	CO3	H	3	H			3	H
	CO4	H	3			H	2	2
	CO5	H	H				H	2
	CO6	H	2	H		H	3	H
3	Category	PROFESSIONAL CORE( PC)						
4	Approval							

## SYLLABUS

### Unit 1:

**8 hours**

Basic Concepts of Dynamic Systems and Stability Definition, Small Signal Stability (Low Frequency Oscillations) of unregulated and Regulated System.

### Unit 2:

**7 hours**

Effect of Damper, Flux Linkage Variation and AVR.

### Unit 3:

**7 hours**

Large Signal Rotor Angle Stability, Dynamic Equivalents And Coherency, Direct Method of Stability Assessment, Stability Enhancing Techniques, Mitigation Using Power System Stabilizer.

### Unit 4:

**8 hours**

Asynchronous Operation and Re-synchronization, Multi-Machine Stability.

### Unit 5:

**8 hours**

Dynamic analysis of Voltage Stability, Voltage Collapse: Introduction to Voltage Stability; Factors affecting voltage instability and collapse; Comparison of Angle and Voltage Stability; Analysis of Voltage Instability and Collapse; Integrated Analysis of Voltage and Angle Stability; Control of Voltage Instability

### Unit 6:

**7 hours**

Frequency Stability, Automatic Generation Control, Primary and Secondary Control, Sub Synchronous Resonance and Counter Measures.

## TEXT BOOK

1. K.R. Padiyar, "Power System Dynamics, Stability and Control", B. S. Publications, 2002.

2. P. Kundur, "Power System Stability and Control", McGraw Hill, 1995.
3. P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 1997.

**REFERENCES**

1. J. Machowski, Bialek, Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997.
2. L. Leonard Grigsby (Ed.); "Power System Stability and Control", Second edition, CRC Press, 2007.
3. V. Ajarapu, "Computational Techniques for voltage stability assessment & control"; Springer, 2006.

Course Coordinator

HOD

<b>P18PCPS2L1</b>	<b>POWER SYSTEM PROTECTION LABORATORY</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 40		0	0	4	2
	Prerequisite - Power system analysis					
	Course Coordinator: Ms.Anitha			Department: EEE		
<p><b>COURSE OBJECTIVES:</b> To gain knowledge of Protection system of Transformer, Generator &amp; Substations.</p>						

<b>COURSE OUTCOMES (COs)</b>		
CO1	U	Remember testing methods on relays and its characteristics
CO2	A	Understand and Study of Transformer Protection by Simulation
CO3	An	Differentiate and Study of Generator and substation Protection by Simulation
CO4	E	Evaluate Radial Feeder and Parallel Feeder Protection schemes
CO5	C	Create simulation of Radial Feeder and Parallel Feeder Protection

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/SOs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	2	H	H		M	2	H
	CO2	2	H	H		M	2	H
	CO3	2	H	H		M	2	H
	CO4	2	H	H		M	2	H
	CO5	2	H	H		M		H

3	Category	Program Core(PC)
4	Approval	

## **SYLLABUS**

1. Testing on (i) Under Voltage Relay and (ii) Earth Fault Relay
2. Testing on (i) on load Time Delay Relay (ii) off load Time Delay Relay
3. Study of Different Characteristics of Over Current Relay
4. Impact of Induction Motor Starting on Power System
5. Study of Transformer Protection by Simulation
6. Study of Generator Protection by Simulation
7. Study of Substation Protection by simulation
8. Modeling of Differential Relay using MATLAB
9. Simulation of Radial Feeder Protection
10. Simulation of Parallel Feeder Protection
11. Simulation of Principle of Reverse Power Protection

Course Coordinator

HOD

<b>P18PCPS2L2</b>	<b>ADVANCED POWER SYSTEM LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 40	0	0	4	2
	Prerequisite - Power system analysis				
	Course Coordinator: Ms.Dhivya      Department: EEE				

**COURSE OBJECTIVES:**

To gain knowledge and simulation of Load Dispatch control system Micro & Smart Grid Control System, Substation controls system and Load shedding control analysis

**COURSE OUTCOMES (COs)**

CO1	U	To identify the operation Power Plants and Power system Control
CO2	A	To demonstrate the Load Dispatch control system
CO3	An	To simulate Micro Grid Control System
CO4	E	To evaluate the simulation of substation controls system
CO5	C	To develop and simulate Smart Grid control System

**Mapping of Course Outcomes with Program outcomes (POs)**

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Sos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	H	H		M		H
	CO2	H	H	H		M		H
	CO3	H	H	H		M		H
	CO4	H	H	H		M		H
	CO5	H	H	H		M		H
3	Category	Program Core (PC)						
4	Approval							

**SYLLABUS**

1. Coordination of Power Plants and Power system Control
2. Simulation of Load Dispatch control system
3. Simulation of Micro Grid Control System
4. Simulation of Smart Grid control System
5. Simulation of Substation controls system
6. Load shedding control analysis

Course Coordinator

HOD

<b>P18PRPS2P1</b>	<b>MINI PROJECT WITH SEMINAR</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 40			3	0	0	3
	Prerequisite – Research Methodology						
	Course Coordinator: Dr.K.Sakthivel			Department: EEE			
<p><b>COURSE OBJECTIVES:</b></p> <ul style="list-style-type: none"> <li>• The purpose of technical seminar is to train the students in preparing and presenting technical topics.</li> <li>• The students are expected to give a presentation on their topics of interest which will be assessed by a Faculty in charge, for this purpose during the current semester as per the academic regulations.</li> <li>• The student shall be capable of identify design, fabricate mini projects of power electronic components</li> </ul>							

CO1	U	To understand the scope and objective of research problems.
CO2	A	Implement procedure for the effective literature studies approaches.
CO3	An	To identify effective technical writing to format the research proposal.
CO4	E	Predict circuits and components for Mini project
CO5	C	Design and implement hardware and software for mini project

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/SOs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1		H	H	M	M	M	M
	CO2		2	H	3	M	3	M
	CO3		H	2	M	M	M	3
	CO4		H	H	M	M	M	M
	CO5	3	3	3	3	3	3	3
3	Category	Project(PR)						
4	Approval							

Course Coordinator

HOD

## PROFESSIONAL ELECTIVE – 1

<b>P18PEPS011</b>	<b>RENEWABLE ENERGY SYSTEM</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45					3	0	0	3
	Prerequisite – Nil								
	Course Coordinator: Dr.K.Sakthivel					Department: EEE			
<b>COURSE OBJECTIVES:</b> Students will be able to learn various renewable energy sources and understanding of integrated operation of renewable energy sources, Interface with the Grid.									

<b>COURSE OUTCOMES (COs)</b> After completion of the course the student will be able to		
CO1	R	Recall the review of conventional energy resources-
CO2	U	Able to understand how renewable energy can be used to help reduce greenhouse gases.
CO3	A	Apply ideas to perform case studies on renewable energy systems.
CO4	An	To analyze about the various renewable energy generation technologies.
CO5	E	Criticize wind, ocean, hydro and solar systems
CO6	C	To design solar energy applications water heaters, air heaters, solar cooking, solar drying and power generation-tower concept (solar plant)-solar pump

<b>Mapping of Course Outcomes with Program outcomes (POs)</b>								
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	M		M	L	L	M	M
	CO2	M		H	L	L	M	M
	CO3	M		M	L	M	2	2
	CO4	M		H	L	L	M	M
	CO5	M		M	L	M	L	L
	CO6	3		2	2	3	3	3
3	Category	Professional Elective (PE)						
4	Approval							

### SYLLABUS

#### Unit1:

**9 hours**

Introduction: Current energy requirements, growth in future energy requirements, Review of conventional energy resources- Coal, gas and oil reserves and resources, Tar sands and OilShale, Nuclear energy Option.

#### Unit2:

**9 hours**

Solar Energy: Solar radiation: measurements and prediction. Solar thermal collectors- flat plate

collectors, concentrating collectors. Basic theory of flat plate collectors, solar heating of Buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems. Solar Photovoltaic: Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes.

**Unit 3:**

**9 hours**

Wind Energy: Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, and Applications.

**Unit 4:**

**9 hours**

Ocean Energy: Ocean energy resources-ocean energy routes - Principles of ocean thermal energy conversion systems- ocean thermal power plants- Principles of ocean wave energy conversion and tidal energy conversion

**Unit 5:**

**9 hours**

Other Sources: Hydropower, Nuclear fission and fusion-Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

**TEXTBOOK**

1. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000.
2. C. S. Solanki, "Solar Photovoltaics: Fundamental Applications and Technologies, Prentice Hall of India, 2009.

**REFERENCES**

1. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.
2. D. A. Spera, Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering, ASME Press.
3. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-

Course Coordinator

HOD

<b>P18PEPS012</b>	<b>HIGH POWER CONVERTERS</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 40					3	0	0	3
	Prerequisite-NIL								
	Course Coordinator: Ms.Anitha					Dept: Electrical & Electronics Engineering			

**COURSE OBJECTIVES:**

Students will be able to understand the requirements of high power rated converters, different topologies involved for these converters and also to understand the design of protection circuits for these converters.

<b>COURSE OUTCOMES (COs)</b>		
CO1	R	Recall the basics of Rectifiers with diodes and SCR's.
CO2	U	Understand the Operation of Inverters and Multilevel Inverters.
CO3	A	Interpret the working of diode clamped and flying capacitor Multilevel Inverter.
CO4	An	Discriminate PWM CSI and DC to DC Converters.
CO5	E	Appraise the operation of Ac Voltage Controllers and UPS.
CO6	C	Develop and design and protection of converters and circuits.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	H	M		M	M	M
	CO2	H	H	M	L	M	M	H
	CO3	M	M	M	M	M	M	M
	CO4	H	H	M	L	M	M	H
	CO5	H	H	M	L	M	M	H
	CO6	M	M	M	M	M	M	H
	Category	Professional Elective (PE)						
4	Approval							

**SYLLABUS**

**Unit 1:**

**6 Hours**

Power electronic systems, an overview of PSDs, multipulse diode rectifier, multipulse SCR rectifier.

**Unit 2:**

**8 Hours**

Phase shifting transformers, multilevel voltage source inverters: twoLevel voltage source inverter, cascaded H bridge multilevel inverter

- Unit3:** **6 Hours**  
Diode clamped multilevel inverters, flying capacitor multilevel inverter
- Unit 4:** **6 Hours**  
PWM current source inverters, DC to DC switch mode converters
- Unit5:** **8 Hours**  
AC voltage controllers: Cyclo-converters, matrix converter, Power conditioners and UPS.
- Unit6:** **6 Hours**  
Design aspects of converters, protection of devices and circuits

**TEXT BOOK**

1. N. Mohan, T. M. Undeland and W. P. Robbins, “Power Electronics: Converter, Applications and Design”, John Wiley and Sons, 1989
2. John Wiley and Sons, 1989

**REFERENCES**

1. M.H. Rashid, “Power Electronics”, Prentice Hall of India, 1994
2. K .Bose, “Power Electronics and A.C. Drives”, Prentice Hall, 1986
3. Bin Wu, “High power converters and drives”, IEEE press, Wiley Enter science

Course Coordinator

HOD

<b>P18PEPS013</b>	<b>WIND AND SOLAR SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 44	3	0	0	3
	Prerequisite – Nil				
	Course Coordinator: Dr.S.Prakash Department: EEE				
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• Students will be able to get exposure to wind and solar systems</li> <li>• To understand the factors involved in installation and commissioning of a Solar or Wind plant.</li> <li>• Learning the dynamics involved when interconnected with power system grid</li> </ul>					

COURSE OUTCOMES (COs)		
CO1	U	Describe the knowledge of the characteristics of wind and solar power generation.
CO2	A	Understand the power quality standards for wind turbines and technical regulations for interconnections of wind farm with power systems.
CO3	An	Understand about the economic aspects based on wind energy systems and reactive control
CO4	E	Carry justification for the impacts on power system dynamics and power system interconnection
CO5	U	Develop the design aspect of solar and wind power generation.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H		H			M	--
	CO2	H		H		M	M	--
	CO3	H		H			M	--
	CO4	H	H	H	H	M	M	--
	CO5	H		H	H		M	--
3	Category	Professional Elective Course (PEC)						
4	Approval	47th Meeting of Academic Council						

## SYLLABUS

### Unit 1:

**8 Hours**

Historical development and current status- characteristics of wind power generation- network integration issues

### Unit 2:

**8 Hours**

Generators and power electronics for wind turbines- power quality standards for wind turbines- Technical regulations for interconnections of wind farm with power systems.

### Unit 3:

**8 Hours**

Isolated wind systems, reactive power and voltage control- economic aspects

### Unit 4:

**8 Hours**

Impacts on power system dynamics- power system interconnection.

### Unit 5:

**8 Hours**

Introduction of solar systems- merits and demerits, concentrators, various applications- Solar thermal power generation- PV power generation- Energy Storage device- Designing the solar system for small installations.

### Text/References:

1. Thomas Ackermann, Editor, "Wind power in Power Systems", John Willy and sons ltd.2005
2. Siegfried Heier, "Grid integration of wind energy conversion systems", John Willy and sons ltd., 2006
3. K. Sukhatme and S.P. Sukhatme, "Solar Energy". Tata MacGraw Hill, Second Edition, 1996

Course Coordinator

HOD

<b>P18 PEPS 014</b>	<b>APPLIED MATHEMATICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Nil				
	Course Coordinator: Dr.Manumegalai		Department : Mathematics		

**COURSE OBJECTIVES:**

To know the basic concepts of advance matrices, calculus of variation, Probability concepts and Random Processtechnique.

**COURSE OUTCOMES (COs)**

CO1	R	Remember manipulate matrices and to do matrix algebra, determinants, Eigen values,Eigen vectors and to solve the system of linear equations
CO2	U	Understand special functions like Bessel functions – Recurrence relations generating functions and orthogonal of Bessel’s functions etc
CO3	A	Apply concepts of Probability to solve problems in Engineering sciences
CO4	An	Analyze the concept of Variation and its properties
CO5	E	Discriminate Probability, Special function and Random Process Techniques.

**Mapping of Course Outcomes with Program outcomes (POs)**

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H		H		L	H	M
	CO2		2				H	M
		3				2		
	CO3	3	2	H		L	H	M
	CO4	2	2	2		2	H	M
	CO5	2	2	2		H	H	M
3	Category	Professional Elective (PE)						
4	Approval							

## **SYLLABUS**

### **Unit 1:Advanced matrix theory**

**12Hours**

Eigen values using QR transformations generalized eigenvectors – canonical forms, singular valued composition and application – matrix norms and induced norms pseudo inverse – least square approximations.

### **Unit2:Calculus of variations**

**12 Hours**

Variation and its properties– Euler’s Equation –Functional dependent on first andhigher order derivatives – functional dependent on functions of several independent variables – constraints in the form of a functional isoperimetric problems – Direct method – Ritz and Kantorovich methods – Boundary value problems.

### **Unit 3: Special Functions**

**12 Hours**

Series solutions – Bessel’s equations – Bessel functions – Recurrence relations generating functions and orthogonal of Bessel’s functions of the first kind Legendary’s equations, Legendary polynomials – Rodriguez’s formula applications to boundary value problems

### **Unit 4: Probability**

**12 Hours**

Probability concepts – Random variables Discrete and continuous dissimulations Correlations partial, multiple, rank analysis of variance one way, two way process.

### **Unit 5:Random process**

**12 Hours**

Poisson process Gaussian process Markov process-Anti Correlations-Cross correlations – Queuing models – quality control – control charts – tolerance limits.

**Total No. of Periods: 60**

## **REFERENCES:**

1. Sankar Rao K: “Introduction to Partial Differential Equations” – Prentice Hall of India, New Delhi 1995.
2. Elsgoth, “Differential Equations and Calculus of Variations” MIR Publishers, Moscow.
3. Grewal B.S. “Higher Engineering Mathematics, Khanna Publications, New Delhi 1989.
4. Andrews L.A. “Special Function of Scientist and Engineers”
5. Venkataramn M.K. “higher engineering mathematics, the National Publishing Company,

	<b>ELECTRIC POWER DISTRIBUTION SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>P18PEPS021</b>	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Nil				
	Course Coordinator: Dr.s.Prakash		Department: Electrical & Electro Engineering		
<b>COURSE OBJECTIVES:</b> Student will gain concept and understand the Power distribution system, SCADA System and Automated Distribution Systems.					

1990.

6. Narayanan S. Manicasachagam Pillai and Ramaniah G. “Advanced Mathematics for Engineering Students” Vol II and III, Viswanathan printers Pvt. Ltd., Madras 1985.
7. Freund J.D. and Miller JR “Probability Statistics for Engineers” Prentice Hall of India, 5<sup>th</sup> Edition, New Delhi 1994.
8. Gupta and Kapoor V.K. “Fundamentals of Mathematics Statistics” Sultan Chand & Sons, New Delhi.

Course Coordinator

HOD

<b>COURSE OUTCOMES (COs)</b> Students will be able to:		
CO1	R	Remember the concept of power distribution system
CO2	U	Understand the concept of Distribution Management System, Control & Communication Systems and SCADA system

CO3	A	Identify Control & Communication Systems and Energy monitoring system
CO4	An	Distinguish interconnection of Distribution, Optimum Switching and energy management
CO5	E	Evaluate different Methods and Constraints Power Factor Correction and automation of distributed network
CO6	C	Develop SCADA based Distribution & automation system

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	2	H		H	1	H
	CO2				2	H	2	H
	CO3	H				H	H	2
	CO4	1	H	2	2	H	2	H
	CO5	2				H	2	H
	CO6	H					2	H
3	Category	Professional Elective Course (PEC)						
4	Approval	47th Meeting of Academic Council						

## SYLLABUS

### Unit 1:

**8Hours**

Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long-term, Power System Loading, Technological Forecasting.

### Unit 2:

**8 Hours**

Advantages of Distribution Management System (D.M.S.) Distribution Automation: Definition, Restoration / Reconfiguration of Distribution Network, Different Methods and Constraints Power Factor Correction

### Unit 3:

**8 Hours**

Interconnection of Distribution, Control & Communication Systems, Remote Metering, Automatic Meter Reading and its implementation

### Unit 4:

**8 Hours**

SCADA: Introduction, Block Diagram, SCADA Applied To Distribution Automation. Common Functions of SCADA, Advantages of Distribution Automation through SCADA

### Unit 5:

**7 Hours**

Calculation of Optimum Number of Switches, Capacitors, Optimum Switching Device Placement in Radial, Distribution Systems, Sectionalizing Switches – Types, Benefits, Bellman's Optimality Principle, Remote Terminal Units, Energy efficiency in electrical distribution & Monitoring

### Unit 6:

**6 Hours**

Maintenance of Automated Distribution Systems Difficulties in Implementing Distribution Automation in Actual Practice, Urban/Rural Distribution, Energy Management, AI techniques applied to Distribution Automation

## REFERENCES:

1. A.S. Pabla, “Electric Power Distribution”, Tata McGraw Hill Publishing Co. Ltd., Fourth Edition.
2. M.K. Khedkar, G.M. Dhole, “A Text Book of Electrical power Distribution Automation”, University Science Press, New Delhi
3. Anthony J Panseni, “Electrical Distribution Engineering”, CRC Press
4. James Momoh, “Electric Power Distribution, automation, protection & control”.

Course Coordinator

HOD

<b>P18PEPS022</b>	<b>Optimization Techniques in Power System</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 42		3	0	0	3
	Prerequisite – NIL					
	Course Coordinator: Dr.T.R.Rangaswamy Department: Electrical & Electro Engineering					

**COURSE OBJECTIVES:**

To gain knowledge of optimization techniques applied to power systems in order to achieve technical and economic efficiency.

**COURSE OUTCOMES (COs)**

CO1	U	Understand the fundamental concepts of economic optimization techniques
CO2	A	Apply the knowledge of Power system controls and optimization techniques like Optimal Load frequency control and Economic Dispatch Control, Automatic Voltage Control, optimal Generation Control etc
CO3	An	Differentiate economic load dispatch and generation scheduling
CO4	E	Justify the multi-objective optimization methods in power system problem solving.
CO5	C	Design and develop application of artificial intelligent techniques in power systems optimization.

**Mapping of Course Outcomes with Program outcomes (POs)**  
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	2	1		M	M	2
	CO2	M	1	1		M	M	H
	CO3	2	1	2		M	M	2
	CO4	2	3	2		M	M	H
	CO5	2	3	3		3	3	H
3	Category	Professional Elective (PE)						
4	Approval							

## SYLLABUS

### Unit 1: Fundamentals of optimization techniques

9 Hours

Definition-Classification of optimization problems-Unconstrained and Constrained optimization-Optimality conditions-Classical Optimization techniques (Lamda Iteration method, linear programming, Quadratic programming). Concept of Particle Swarm Optimization and Genetic Algorithm

### Unit 2: Optimal Power System Operation & Control

9 Hours

Optimal Operation of generators on a bus bar, Optimal spinning reserve, Introduction Load Frequency Control, Turbine Speed Governing System, Generator Load Model, Optimal Load frequency control and Economic Dispatch Control, Automatic Voltage Control, optimal Generation Control.

### Unit 3: Optimal Load Dispatch of Generating Units

9 Hours

Optimal Economic Dispatch problem on a bus bar, optimal generation scheduling, Economic dispatch using Newton-Raphson method- Concept of State, Regional and Central Load dispatch center-Responsibilities and functions of State Load Dispatch Centre.

### Unit 4: Multi-Objective Optimal Generation Scheduling

9 Hours

Multi objective optimization- State of the art, Fuzzy set theory in power system, State Load Dispatch Centre. Concept of State, Regional and Central Load dispatch center.multi objective thermal power dispatch problem, multi objective dispatch for active & reactive power balance. Introduction, multi-objective stochastic optimal thermal power dispatch.

### Unit 5: Application of optimization techniques in power systems

9 Hours

Algorithms and flow chart of various optimization techniques for solving economic load dispatch in Smart Grid and Micro Grid system. Optimal utilization of renewable energy resources in Smart grid environment. Application of artificial intelligent techniques in power systems optimization.

### Text/Reference Books

1. Kothari D.P, Dhillon J.S, "Power System Optimization" – PHI Private Limited. 2010
2. JJames A Momoh, "Electric Power System Application of Optimization", CRC Press2001
3. S.S. Rao, "Engineering Optimization-Theory and Practice Power", 2009 John Willey &Sons, New York, USA.
4. A.D. Belegundu, T.R. Chandrupatla, "Optimization Concepts and Applications in Engineering", Cambridge, University press 2011
5. Haoyong Chen, Yongjun Zhang, Honwing Ngan." Power System Optimization: Large-scale

Course Coordinator

HOD

<b>P18PEPS023</b>	<b>PULSE WIDTH MODULATION FOR PE CONVERTERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Coordinator: Ms.Anitha		Department: Electrical & Electro Engineering		
<b>COURSE OBJECTIVES:</b> To understand necessity and Importance of PWM techniques and implementation of PWM controllers					

<b>COURSE OUTCOMES (COs)</b>		
CO1	U	Understand the concept of Power electronic converters and single & multi level inverters.
CO2	A	Classify different modulation strategies.
CO3	An	Analyze the performance of converter for different PWM techniques Understand the knowledge of Over Modulation.
CO4	E	Differentiate Zero space vector placement and PWM techniques
CO5	C	Develop implementation of modulation controller.

<b>Mapping of Course Outcomes with Program outcomes (SOs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Sos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	M	2	1		M	H	2
	CO2	M	H	1		M	H	2
	CO3	2	2	H		M	H	2
	CO4	M	H	H		3	H	2
	CO5	3	H	H		M	H	3
3	Category	Professional Elective (PE)						
4	Approval							

## **SYLLABUS**

### **Unit 1:**

**8 hours**

Introduction to PE converters, Modulation of one inverter phase leg, Modulation of single phase, VSI and 3 phase VSI

### **Unit 2:**

**8 hours**

Zero space vector placement modulation strategies, Losses-Discontinuous modulation, Modulation of CSI

### **Unit 3:**

**8 hours**

Over modulation of converters, programme modulation strategies.

### **Unit 4:**

**9 hours**

Pulse width modulation for multilevel inverters, Implementation of modulation controller.

### **Unit 5:**

**12 hours**

Continuing developments in modulation as random PWM, PWM for voltage unbalance. Effect of minimum pulse width and dead time

**TEXT BOOK / REFERENCES:**

1. D. Grahame Holmes, Thomas A. Lipo, “Pulse width modulation of Power Converter: Principles and Practice”, John Wiley & Sons, 03-Oct-2003
2. Bin Vew, “High Power Converter”, Wiley Publication
3. Marian K. Kazimirczuk, “Pulse width modulated dc-dc power converter”, Wiley Publication.

Course Coordinator

HOD

<b>P18PEPS024</b>	<b>ELECTRIC AND HYBRID VEHICLES</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45			3	0	0	3
	Prerequisite – <b>Electric Drives</b>						
	Course Coordinator: Dr.S.Prakash Department: Electrical & Electronics Engineering						
<b>OBJECTIVES</b>							
<ul style="list-style-type: none"> <li>• Students will be able to Understand upcoming technology of hybrid system</li> <li>• To understand different aspects of drives application.</li> <li>• To Learn the electric Traction</li> </ul>							

<b>COURSE OUTCOMES (COs)</b>		
CO1	U	To explain basics of vehicle performance. Vehicle power source characterization. Transmission characteristics.
CO2	A	Classify various hybrid drive-train topologies Traction,
CO3	An	Analyze support systems for Hybrid vehicles and concept of Selecting the energy Storage technology and fuel efficiency .
CO4	E	Criticize about electric drives for Hybrid vehicles and internal combustion engine
CO5	C	Categorize electric components used in hybrid and electric vehicles

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H		H	H		M	2
	CO2	M		H	H		M	--
	CO3	M		H	H		M	--
	CO4	M		H	H		M	2
	CO5	H	H	H	H		M	2
3	Category	Professional Elective (PE)						

4	Approval	
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## **SYLLABUS**

### **Unit 1:**

**9 Hours**

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

### **Unit2:**

**9 Hours**

Basic concept of hybrid traction. Introduction to various hybrid drive-train topologies. Power flow control in hybrid drive-train topologies. Fuel efficiency analysis.

### **Unit3:**

**9 Hours**

Basic concepts of electric traction. Introduction to various electric drive-train topologies. Power flow control in hybrid drive-train topologies. Fuel efficiency analysis

### **Unit4:**

**9 Hours**

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.

### **Unit5:**

**9 Hours**

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. Introduction to energy management and their strategies used in hybrid and electric vehicle. Classification of different energy management strategies. Comparison of different energy management strategies. Implementation issues of energy strategies.

## **TEXT BOOK:**

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003. Reference Books:

## **REFERENCES:**

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
2. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000  
.http://nptel.ac.in/courses/108103009/

Course Coordinator

HOD

### PROFESSIONAL ELECTIVE - 3

<b>P18PEPS031</b>	<b>RESTRUCTURED POWER SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Power System analysis				
	Course Coordinator: Dr.V.Jayalakshmi		Department: Electrical & Electro Engineering		

#### OBJECTIVES

To study the complete process of deregulation and restructuring of Power Industry.

#### COURSE OUTCOMES (COs)

CO1	R	To recall fundamentals of restructured system and architecture
CO2	U	To understand of integrating system , congestion management and Risk assessment
CO3	A	To know the implementation of distributed generation in restructured markets and IT applications in restructured markets
CO4	An	To differentiate Risk assessment and Recent trends in Restructuring
CO5	E	To criticize the role in vertically integrated systems and in restructured markets,
CO6	C	Understand the recent trends in restructured power systems.

#### Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	M		H			H	M
	CO2			H		L	H	M
	CO3	M	M				H	M
	CO4	M		H			H	M
	CO5	M	L	H			H	M
	CO6	M		H			H	M
3	Category	Professional Elective (PE)						
4	Approval							

#### SYLLABUS

##### Unit 1:

**8 hours**

Fundamentals of restructured system, Market architecture, Load elasticity, Social welfare maximization.

##### Unit 2:

**8 hours**

OPF: Role in vertically integrated systems and in restructured markets, congestion management

##### Unit 3:

**8 hours**

Optimal bidding, Risk assessment, Hedging, Transmission pricing, Tracing of power.

**Unit 4:** **8 hours**

Ancillary services, Standard market design, Distributed generation in restructured markets.

**Unit 5:**

Development in India, IT applications in restructured markets. **7 hours**

**Unit 6:** **6 hours**

Working of restructured power systems, PJM, Recent trends in Restructuring.

**TEXT BOOK**

1. Sally Hunt,” Making competition work in electricity”, , John Willey and Sons Inc. 2002
2. Steven Stoft,” Power system economics: designing markets for electricity”, John Wiley & Sons, 2002.
3. Mohammad Shahidehpour, MuwaffaqAlomoush, Marcel Dekker, “Restructured electrical power systems: operation, trading and volatility” Pub., 2001

**REFERENCES**

1. LorrinPhilipson, H. Lee Willis, “Understanding electric utilities and de-regulation”, Marcel Dekker Pub, 1998.
2. Steven Stoft, “Power system economics: designing markets for electricity”, John Wiley and Sons, 2002.
3. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, “Operation of restructured power systems”, Kluwer Academic Pub, 2001.
4. Mohammad Shahidehpour, MuwaffaqAlomoush, “Restructured electrical power systems: operation, trading and volatility”, Marcel Dekker.

Course Coordinator

HOD

<b>P18PEPS032</b>	<b>SMART GRIDS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45		3	0	0	3
	Prerequisite – Power System Analysis					
	Course Coordinator: Dr.K.Sakthivel			Department: Electrical Electronics Engineering		
<p><b>COURSE OBJECTIVES:</b></p> <ol style="list-style-type: none"> <li>1. Understand concept of smart grid and its advantages over conventional grid.</li> <li>2. Know smart metering techniques.</li> <li>3. Learn wide area measurement techniques.</li> <li>4. Understanding the problems associated with integration of distributed generation &amp; its Solution through smart grid.</li> </ol>						
<b>COURSE OUTCOMES (COs)</b>						
CO1	R	To recall the concepts and design of Smart grid and micro-grid				
CO2	U	To understand the various communication and measurement technologies in smart grid.				
CO3	A	To classify the smart grid integration technologies and its components				
CO4	An	To identify the stability of smart grid and power Quality issues of Grid connected				

		Renewable Energy Sources
CO5	Ev	To evaluate the high performance computing techniques for Smart Grid applications Sand summaries it Geographic Information System
CO6	C	To plan the Power Quality issues of Grid connected with Renewable Energy Sources

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Sos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	1		2			H	M
	CO2	2		2		M	H	M
	CO3	2	1	2		M	H	M
	CO4	3	1	3			H	M
	CO5	2		2		M	H	M
	CO6	3		3		M	H	M
3	Category	Professional Elective (PE)						
4	Approval							

## SYLLABUS

### Unit1:

**6 hours**

Introduction to Smart Grid, Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Concept of Robust & Self-Healing Grid, Present development & International policies in Smart Grid

### Unit 2:

**8 hours**

Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation

### Unit 3:

**6 hours**

Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).

### Unit 4:

**8 hours**

Concept of micro-grid, need & applications of micro-grid, Formation of micro-grid, Issues of interconnection, Protection & control of micro-grid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources.

### Unit 5:

**8 hours**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit

### Unit 6:

**9 hours**

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network. Basics of CLOUD Computing & Cyber Security for Smart Grid, Broadband

over Power line (BPL). IP based protocols

**TEXT BOOK**

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE, 2011.
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press, 2009.

**REFERENCES:**

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, “Smart Grid: Technology and Applications”,Wiley 2012.
2. Stuart Borlas’e, “Smart Grid:Infrastructure, Technology and solutions “CRC Press.
3. A.G.Phadke , “Synchronized Phasor Measurement and their Applications

Course Coordinator

HOD

<b>P18PEPS033</b>	<b>DYNAMICS OF ELECTRICAL MACHINES</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45		3	0	0	3
	Prerequisite –Power System Dynamics I					
	Course Coordinator: Ms.Anitha			Department: Electrical & Electro Engineering		
<b>OBJECTIVES</b>						
To gain fundamental knowledge about Dynamics of Electrical machines and its characteristic						
<b>COURSE OUTCOMES (COs)</b>						
CO1	U	To summarize the operation of DC,AC and Synchronous machines				
CO2	A	To demonstrate Torque Equation of DC machines and Large Signal Transient Analysis using Transformed Equations				
CO3	An	To perform dynamic analyses of Synchronous Motor System and Steady State Analysis of Salient pole machines				
CO4	Ev	To distinguish Large Signal Transient of Salient Pole Machine and Interconnected Machines,				
CO5	C	To plan dynamic analysis of Synchronous Motor and Interconnected Machines.				

**Mapping of Course Outcomes with Program outcomes (POs)**

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	M	L	2		H	M	L
	CO2	L	H	3		H	M	M
	CO3	M	H	3		H	H	H
	CO4	M	M	3		H	H	H
	CO5	3	H	2		H	M	M
3	Category	Professional Elective (PE)						
4	Approval							

## SYLLABUS

### Unit 1: Basic Primitive Machines

**10 hours**

Stability- Primitive Winding Commutator Machine. Commutator Primitive Machine-Complete Voltage Equation of Primitive Winding Commutator

### Unit2:DC Machines

**10 hours**

Torque Equation. Analysis of Simple DC Machines using the Primitive Machine Equations- the Three Phase Induction Motor. Transformed Equations- Different Reference Frames for induction Motor Analysis Transfer Function Formulation

### Unit 3:Salient Pole Machine

**6 hours**

Three Phase Salient Pole Synchronous Machine- Parks Transformation- Steady State Analysis

### Unit 4:Interconnected Machines

**6hours**

Large Signal Transient. Small Oscillation Equations in State Variable form Dynamical Analysis of Interconnected Machines.

### Unit 5:Transformers

**9 hours**

Large Signal Transient Analysis using Transformed Equations- DC Generator /DC Motor System.

### Unit 6: Synchronous Motor

**4 hours**

Dynamic analyses of alternator /Synchronous Motor System.

## TEXT BOOK

1. P.C. Kraus, "Analysis of Electrical Machines", McGraw Hill Book Company, 1987
2. C.V. Jones, "The Unified Theory of Electrical Machines", Butterworth, London. 1967\

## REFERENCE

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. I. Boldia& S.A. Nasar,"Electrical Machine Dynamics", the Macmillan Press Ltd. 1992

Course Coordinator

HOD

<b>P18PEPS034</b>	<b>POWER APPARTUS DESIGN</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45					3	0	0	3
	Prerequisite – Power System Analysis								
	Course Coordinator: Ms.Anitha					Department: Electrical & Electro Engineering			
<b>OBJECTIVES</b>									
<ul style="list-style-type: none"> <li>To gain knowledge of Principles of Design of Machines and transformers</li> </ul>									
<b>COURSE OUTCOMES (COs)</b>									
Students will be able to:									
CO1	R	Remember the basic concepts in electrical machines.							
CO2	U	Understand and gain knowledge about Sizing of a transformer and temperature rise in transformers, Induction Motors and leakage reactance of poly phase machines, Sizing of a synchronous machine							
CO3	A	Apply design procedure applicable to various electrical machines.							
CO4	An	Analyze the design procedure for various electrical machines in Computer aided Design (CAD)							
CO5	Ev	Evaluate the various design procedures for electrical machines.							
CO6	C	Design various Electrical machines parts using Computer aided Design (CAD)							

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	H	H		H	H	
	CO2	H	H	H		H	H	
	CO3	H	H	H		H	H	
	CO4	H	H	H		H	H	
	CO5	H	H	H		H	H	
	CO6	H	H	H		H	H	
3	Category	Professional Elective Course (PEC)						
4	Approval	47th Meeting of Academic Council						

## SYLLABUS

### Unit 1:

**8 HOURS**

Principles of Design of Machines -Specific loadings, choice of magnetic and electric loadings, real and apparent flux densities, temperature rise calculation, Separation of main dimension for DC machines, Induction machines and synchronous machines, Design of Transformers-General considerations, output equation, emf perturn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling.

### Unit2:

**8 HOURS**

Specific loadings, choice of magnetic and electric loadings Real and apparent flux -densities, temperature rise

calculation, Separation of main dimension for DC machines, Induction machines and synchronous machines, Heating and cooling of machines, types of ventilation, continuous and intermittent rating

**Unit3: 8 HOURS**

General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling tubes, Calculation of losses, efficiency and regulation

**Unit4: 8 HOURS**

General considerations, output equation, Choice of specific electric and magnetic loadings, efficiency, power factor, Number of slots in stator and rotor, Elimination of harmonic torques.

**Unit5: 6 HOURS**

Design of stator and rotor winding, slot leakage flux Leakage reactance, equivalent resistance of squirrel cage rotor, Magnetizing current, efficiency from design data

**Unit6: 7 HOURS**

Types of alternators, comparison, specific loadings, output co-efficient, design of main dimensions  
Introduction to Computer Aided Electrical Machine Design Energy efficient machines

**TEXT BOOK/REFERENCES**

1. Clayton A.E, “The Performance and Design of D.C. Machines”, Sir I. Pitman & sons, Ltd.
2. M.G. Say, “The Performance and Design of A.C. Machines “, Pitman
3. Sawhney A.K, “A course in Electrical Machine Design”, DhanpatRai& Sons, 5<sup>th</sup> Edition

Course Coordinator

HOD

**PROFESSIONAL ELECTIVE – 4**

<b>P18PEPS041</b>	<b>ADVANCED MICRO-CONTROLLER BASED SYSTEMS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 44				3	0	0	3
	Prerequisite – Nil							
	Course Coordinator: Dr.S.P.Vijayargavan				Department: Electrical & Electro Engineering			

**COURSE OBJECTIVES:**

To understand the architecture of advance microcontrollers and FPGA, the applications of micro controllers.

**COURSE OUTCOMES (COs)**

CO1	R	To recall the architecture of Basic Computer Organization
CO2	U	To understand about Hardware/software co-design aspects Micro Controllers
CO3	A	To demonstrate different Interfacing techniques and DSP architecture

CO4	A n	To analyze various interfacing circuits necessary for various applications						
CO5	E	To compare Micro-Controllers-Intel 8051 and PIC 16F877						
CO6	C	To develop for motor control applications using Assembly language programming						
<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	M	M	M	H	M	H	M
	CO2	M	M	M	H	M	H	M
	CO3		M	H	H	H	H	M
	CO4		M	H	H	H	H	M
	CO5	M	M	M	H	M	H	M
	CO6			L	H		H	M
3	Category	Professional Elective Course (PEC)						
4	Approval	47th Meeting of Academic Council						

## SYLLABUS

### Unit 1

**8 Hours**

Basic Computer Organization, Accumulator based Processes-Architecture Memory Organization-I/O Organization

### Unit 2

**8 Hours**

Micro-Controllers-Intel 8051, Intel 8056-Registers, Memories I/O Ports, Serial Communication Timers, Interrupts, Programming

### Unit 3

**8 Hours**

Intel 8051 – Assembly language programming Addressing-Operations Stack & Subroutines Interrupts-DMA

### Unit 4

**8 Hours**

PIC 16F877- Architecture Programming Interfacing Memory/ I/O Devices Serial I/O and data communication

### Unit 5

**7 Hours**

Digital Signal Processor (DSP) Architecture – Programming Introduction to FPGA

### Unit 6

**6 Hours**

Microcontroller development for motor control applications Stepper motor control using micro controller

## TEXT BOOK

1. John.F.Wakerly: “Microcomputer Architecture and Programming”, John Wiley and Sons 1981.
2. Kenneth J. Ayala, “The 8051 microcontroller”, Cengage Learning, 2004
3. John Morton, “The PIC microcontroller: your personal introductory course”, Elsevier, 2005

## REFERENCES

1. Raj Kamal: “The Concepts and Features of Microcontrollers”, Wheeler Publishing, 2005.
2. Dogan Ibrahim, “Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series”, Elsevier, 2008 Microchip datasheets for PIC16F877

<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low
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Course Coordinator

HOD

<b>P18PEPS042</b>	<b>SCADA SYSTEM AND APPLICATIONS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45		3	0	0	3
	Prerequisite – Nil					
	Course Coordinator: Dr.V.Jayalakshmi		Department: Electrical & Electro Engineering			
<b>OBJECTIVES</b>						
To understand the operation, communication, functions and applications of SCADA.						
<b>COURSE OUTCOMES (COs)</b>						
CO1	U	To Explain the components of SCADA.				
CO2	A	To demonstrate the supervisory functions of SCADA. And need of all components.				
CO3	A n	To discriminate PLC and SCADA architecture				
CO4	E	To compare Communication Technologies and Supervisory functions of SCADA.				
CO5	C	To design the applications of SCADA for Transmission and Distribution Oil, gas and Water industries				

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2		
2	CO1	H				H	H	M		
	CO2	H	M		H	H	H	M		
	CO3	H	M		H	H	H	M		
	CO4	H				H	H	M		
	CO5	H				H	H	M		
	CO6	H			H	H	H	M		
3	Category	Professional Elective (PE)								
4	Approval									
<b>POWER QUALITY</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>

## SYLLABUS

### Unit 1: 8 Hours

Introduction to SCADA-Data acquisition systems-Evolution of SCADA-Communication technologies.

### Unit 2: 7 Hours

Monitoring and supervisory functions-SCADA applications in Utility Automation-Industries SCADA.

### Unit 3: 8 Hours

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 4: 8 Hours

SCADA Architecture-Variou SCADA architectures, advantages and disadvantages of each system-single unified standard architecture -IEC 61850.

### Unit 5: 8 Hours

SCADA Communication- various industrialcommunication technologies-wired and wireless methods and fiber optics-Open standard communication protocols.

### Unit 6: 6 Hours

SCADA Applications: Utility applications-Transmission and Distribution sector operations, monitoring, analysis and Improvement- Industries- Oil, gas and Water.

## TEXT BOOKS

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 2004.
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.

## Reference Books

1. William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006.
2. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 200
3. Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", PennWell 1999.

Total Contact Periods – 45	3	0	0	3
Prerequisite – Power system Analysis				
Course Coordinator: Dr.S.Prakash		Department: Electrical & Electro Engineering		

### OBJECTIVES

Students will be able to understand the overview of **power quality** phenomena and classification of power quality issues.

COURSE OUTCOMES (COs)		
CO1	U	To explain overview of power Quality phenomena, Harmonic and Power factor improvement.
CO2	A	To examine the skills needed for modeling and analysis of harmonics
CO3	An	Analyze the causes and mitigation of harmonics with the characteristics of power system with harmonics.
CO4	Ev	Assess the active power factor correction based on static VAR Compensators and its control techniques.
CO5	C	To design and simulate control system for harmonic reduction and power factor improvement.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	H	H	H		H	M	--
	CO2	H	H	H		L	M	--
	CO3	H	H	H		L	M	--
	CO4	H	M	H	M	H	M	--
	CO5	H	M	H	M	H	M	--
3	Category	Professional Elective Course (PEC)						
4	Approval	47th Meeting of Academic Council						

## SYLLABUS

### Unit1:

**5 hours**

Introduction-power quality-voltage quality-overview of power Quality phenomena classification of power quality issues .Quality phenomena classification of power quality issues. Power quality measures and standards-THD-TIF-DIN-C-message weights. Flicker factor transient phenomena-occurrence of power quality problems Power acceptability curves-IEEE guides Standards and recommended practices.

### Unit2:

**8 hours**

Harmonics-individual and total harmonic distortion RMS value of a harmonic waveformTriplex

harmonics. Important harmonic introducing devices. SMPS Three phase power converters-arcng devices saturable devices Harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

**Unit3:**

**6 hours**

Modeling of networks and components under non-sinusoidal conditions Transmission and distribution systems Shunt capacitors-transformers. Electric machines. Ground systems loads that cause power quality problems. Ground systems loads that cause power quality problems .Power quality problems created by drives and its impact on drive.

**Unit4:**

**6 hours**

Power factor improvement- Passive Compensation. Passive Filtering. Harmonic Resonance. Impedance Scan Analysis Power Factor Corrected Single Phase Front End Control Methods for Single Phase APFC. Three Phase APFC and Control Techniques PFC based on Bilateral Single Phase and Three Phase Converter.

**Unit 5:**

**6 hours**

Hamilton-Jacobi-Bellman equation - model reference adaptive systems Introduction to design method based on the use of Liapunov function(MRAS) - Design hypothesis. Design and simulation of variable structure adaptive model control.

**TEXT BOOKS /REFERENCES:**

1. G.T. Heydt, “Electric power quality”, McGraw-Hill Professional, 2007
2. Math H. Bollen, “Understanding Power Quality Problems”, IEEE Press, 2000
3. J. Arrillaga, “Power System Quality Assessment”, John wiley, 2000
4. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,”Power system Harmonic Analysis”, Wiley,1997

Course Coordinator

HOD

<b>P18PEPS044</b>	<b>ARTIFICIAL INTELLIGENCE TECHNIQUES</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45		3	0	0	3
	Prerequisite – Nil					
	Course Coordinator: Dr.V.Jayalakshmi Department: Electrical & Electro Engineering					
<b>COURSE OBJECTIVES</b>						
Students will be able to understand fuzzy logic, neural network and applications						
<b>COURSE OUTCOMES (COs)</b>						
CO1	U	To summarize the functions of artificial intelligent networks and Genetic Algorithm				
CO2	A	To examine AI techniques for knowledge representation, planning and uncertainty Management of fuzzy logic and various schemes of Neural network				
CO3	A n	To Develop the Fuzzy and Neuro- fuzzy systems				
CO4	E	To compare the superiority of Neural network and fuzzy logic network.				
CO5	C	To design and develop intelligent system for industrial applications.				

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	M	2		H	H	H	M
	CO2	2	L		H		H	M
	CO3	H	2		H	H	H	M
	CO4	H			H		H	M
	CO5	3	L		H	3	H	M
3	Category	Professional Elective (PE)						
4	Approval							

## Syllabus

**Unit 1:** **8 hours**

Biological foundations to intelligent Systems-Artificial Neural Networks, Single layer and Multilayer Feed Forward NN- LMS and Back Propagation Algorithm- Feedback networks and Radial Basis Function Networks

**Unit 2:** **8 Hours**

Fuzzy Logic-Knowledge Representation and Inference Mechanism-Defuzzification Methods.

**Unit 3:** **8 Hours**

Fuzzy Neural Networks-some algorithms to learn the parameters of the network like GA.

**Unit 4:** **8 Hours**

System Identification using Fuzzy and Neural Network.

**Unit 5:** **8 Hours**

Genetic algorithm-Reproduction cross over, mutation-Introduction to evolutionary program.

**Unit 6:** **5 Hours**

Applications of above mentioned techniques to practical problems

## TEXTBOOKS /REFERENCES

1. J M Zurada , "An Introduction to ANN", JaicoPublishing House
2. Simon Haykins, "Neural Networks", Prentice Hall
3. Timothy Ross, "Fuzzy Logic with Engg. Applications", McGraw. Hill
4. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication
5. Golding, "Genetic Algorithms", Addison-Wesley Publishing Com

Course Coordinator

HOD

**PROFESSIONAL ELECTIVE- V**

<b>P18PEPS051</b>	<b>POWER SYSTEM TRANSIENTS</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45						3	0	0	3
	Pre requisite– Power System Analysis									
	Course Coordinator: Dr.V.Jayalakshmi Department: Electrical & Electronics Engineering									
<b>COURSE OBJECTIVES:</b>										
Students will be able to:										
<ul style="list-style-type: none"> <li>Learn the reasons for occurrence of transients in a power system</li> <li>Understand the change in parameters like voltage , frequency and lightning during transients</li> </ul>										
<b>COURSE OUTCOMES (COs)</b>										
<b>Students will be able to:</b>										
CO1	R	To Remember the Fundamental circuit analysis of electrical transients								
CO2	U	To Understand the concepts of switching transients and damping, transients in DC and three phase circuits.								
CO3	A	To Apply digital computation for transient analysis								
CO4	An	To analyze transient phenomena and develop the strategies to mitigate associated problems.								
CO5	Ev	To Evaluate the transient process due to lightning								
CO6	C	To Configure the transients using EMTP/ATP software								
<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low										
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2		
2	CO1	3	3			2	3			
	CO2			3					3	
	CO3								3	
	CO4						3			
	CO5						3			
	CO6			3						2
3	Category	Professional Elective (PE)								
4	Approval									

**UNIT 1**

**8 hours**

Fundamental circuit analysis of electrical transients,Laplace Transform method of solving simple Switching transients, damping circuits -Abnormal switching transients, Three-phase circuits and transients,Computation of power system transients.

**UNIT 2****8 hours**

Principle of digital computation – Matrix method of solution, Modal analysis- Z transform- Computation using EMTP, Lightning, switching and temporary over voltages, Lightning, Physical phenomena of lightning.

**UNIT 3****8 hours**

Interaction between lightning and power system, Influence of tower footing resistance and Earth Resistance, Switching: Short line or kilometric fault, Energizing transients - closing and re-closing of lines, line dropping, load rejection – over voltages induced by faults

**UNIT 4****8 hours**

Switching HVDC line Travelling waves on transmission line, Circuits with distributed Parameters, Wave Equation, Reflection, Refraction, Behavior of Travelling waves at the line terminations, Lattice Diagrams – Attenuation and Distortion, Multi-conductor system and Velocity wave.

**UNIT 5****6 hours**

Insulation co-ordination: Principle of insulation, co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS), Co-ordination between insulation and protection level, Statistical approach.

**UNIT 6****6 hours**

Protective devices, Protection of system against over voltages, lightning arresters, substation earthing.

**TEXT BOOKS**

1. Allan Greenwood, 'Electrical Transients In Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic Transients In Power System", John Wiley And Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A Statistical Approach', PHI Learning Private Limited, Second Edition, 2010.

**REFERENCES**

1. M.S.Naidu And V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook Of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution And Use," Wiley, 2012.

Course Coordinator

HOD

<b>P18PEPS052</b>	<b>FACTS AND CUSTOM POWER DEVICES</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45						3	0	0	3
	Pre requisite– Power System									
	Course Coordinator: Dr.V.Jayalakshmi Department: Electrical & Electronics Engineering									
<b>COURSE OBJECTIVES:</b>										
<ol style="list-style-type: none"> <li>1. Students will be able to learn the active and reactive power flow control in power system</li> <li>2. To understand the need for static compensators. To develop the different control strategies used for compensation</li> </ol>										
<b>COURSE OUTCOMES (COs)</b>										
CO1	R	To Remember power flow control in Power Systems								
CO2	U	To Understand the necessity and various types of FACTS controllers								
CO3	A	To Apply suitable FACTS controllers for power system stability improvement								
CO4	An	To analyze the characteristics of different FACTs controllers and defend the choice of a particular controller to suit the given system/ scenario								
CO5	Ev	To Evaluate Unified Power Flow Controller for real and reactive power flow control								
CO6	C	To develop the modeling and analyze the FACTS controllers								
<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low										
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2		
2	CO1	3		3			2	--		
	CO2	3		3			2	--		
	CO3	3		3			2	--		
	CO4	3		3			2	--		
	CO5	3		3	3		2	--		
	CO6	3		3			2			
3	Category	Professional Elective (PE)								
4	Approval									

### UNIT 1

**9 hours**

Reactive power flow control in Power Systems- Control of dynamic power unbalances in Power System - Power flow control- Constraints of maximum transmission line loading- Benefits of FACTS Transmission line compensation- Uncompensated line -Shunt compensation, Series compensation Phase angle control- Reactive power compensation Shunt and Series compensation. Principles- Reactive compensation at transmission and distribution level.

**UNIT2****9 hours**

Static versus passive VAR compensator- Static shunt compensators: SVC and STATCOM Operation and control of TSC, TCR and STATCOM –Compensator control- Comparison between SVC and STATCOM

**UNIT3****9 hours**

Static series compensation: TSSC, SSSC -Static voltage and phase angle regulator- TCVR and TCPAR Operation and Control Applications, Static series compensation- GCSC, TSSC, TCSC and Static synchronous series compensators and their Control

**UNIT4****9 hours**

SSR and its damping Unified Power Flow Controller Circuit Arrangement, Operation and control of UPFC- Basic Principle of P and Q control- Independent real and reactive power flow control- Applications

**UNIT 5****9 hours**

Introduction to interline power flow controller Modeling and analysis of FACTS Controllers- Simulation of FACTS controllers Power quality problems in distribution systems, harmonics, loads that create harmonics- modeling, harmonic propagation, series and parallel resonances mitigation of harmonics- passive filters, active filtering – shunt , series and hybrid and their control. Voltage swells , sags, flicker, unbalance and mitigation of these problems by power line conditioners IEEE standards on power quality.

**TEXT/REFERENCES**

1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007.
2. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control", Springer Verlag, Berlin, 2006.
3. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.
4. K.S.Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut, 2003.
5. G. T.Heydt, "Power Quality", McGraw-Hill Professional, 2007.
6. T. J. E. Miller, "Static Reactive Power Compensation", John Wiley and Sons, Newyork, 1982.

Course Coordinator

HOD

<b>P18PEPS053</b>	<b>INDUSTRIAL LOAD MODELING AND CONTROL</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Pre requisite– Control System & Power System				
	Course Coordinator: Dr.S.Prakash Department: Electrical & Electronics Engineering				
<b>COURSE OBJECTIVES:</b> To gain fundamental knowledge of Industrial Load Modeling and Control.					
<b>COURSE OUTCOMES (COs)</b>					

CO1	U	Understand the energy demand scenario.						
CO2	U	Understand the modeling of load and pricing analyzes.						
CO3	A	Analyze systems in complex frequency domain and Study Reactive power management in Industries						
CO4	An	Understand the Knowledge about cooling and heating loads and optimization.						
CO5	Ev	Evaluate about captive power units and co-generation.						
CO6	C	Create the integrated load management and optimization.						
<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
2	CO1	3	3	3	1		3	2
	CO2	3	2		2		3	2
	CO3	3	3	3	1		3	2
	CO4	2	2		2		3	2
	CO5	3	2		2		3	2
	CO6	3	3	3	1		3	2
3	Category	Professional Elective (PE)						
4	Approval							

### UNIT 1

**8 hours**

Electric Energy Scenario-Demand Side Management-Industrial Load Management. Load Curves-Load Shaping Objectives.Methodologies-Barriers.ClassificationofIndustrialLoads.Continuous and Batch processes -Load Modeling.

### UNIT 2

**8 hours**

Electricity pricing – Dynamic and spot pricing –Models.Direct load control- Interruptible load control.Bottom up approach- scheduling- Formulation of loadModels.Optimization and control algorithms - Case studies

### UNIT 3

**8 hours**

Reactive power management in industriescontrols-power quality impactsapplication of filters Energy saving in industries.

### UNIT 4

**8 hours**

Cooling and heating loads.loadprofilingModeling- Cool storageTypes-Control strategiesoptimaloperation.Problem formulation- Case studies.

### UNIT 5

**6 hours**

Captive power units-operating and control strategiesPower Pooling- Operation models-Energy bankingIndustrial Cogeneration

### UNIT 6

**6 hours**

Selection of Schemes .Optimal Operating Strategies.Peak load savingConstraints. Problem formulation- Case study.Integrated Load management for Industries.

### 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, pp. 3-28.

### REFERENCES

- 1.Y. Manichaikul and F.C. Schweppes , " Physically based Industrial load", IEEE Trans. on PAS, April 1981
2. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Intescience Publication, USA, 1989.
- 3.I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, NewDelhi, 1995
- 4.IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.

Course Coordinator

HOD

<b>P18PEPS054</b>		<b>DYNAMICS OF LINEAR SYSTEMS</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		Total Contact Periods – 45					3	0	0	3
		Pre requisite– Control System								
		Course Coordinator: Ms.S.Dhivya Department: Electrical & Electronics Engineering								
<b>COURSE OBJECTIVES:</b> Students will be able to To understand the dynamics of linear system and its functions										
<b>COURSE OUTCOMES (COs)</b>										
CO1	R	To Remember the State variable representations of systems								
CO2	U	To Understand the Analysis of linear time varying systems and stability								
CO3	A	To Apply Ackerman’s Formula and Asymptotic observers for state measurement.								
CO4	An	To analyze controllability and observability of the system using state model								
CO5	Ev	To Evaluate Stability analysis using Lyapunov method								
CO6	C	To Design the Matlab Real Time programming to the observers								
<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low										
1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2		
2	CO1	3	3	3		3	3	1		
	CO2	3	1	3			3	1		
	CO3	3	2	3	3	2	3	1		
	CO4	3	2	2			3	1		
	CO5	3	1	2		2	3	1		
	CO6	3	2	2	3		3	1		

3	Category	Professional Elective Course(PE)
4	Approval	

### **UNIT 1**

**8 hours**

State variable representations of systems. Transfer function and transfer function matrix. Solutions of state equations.

### **UNIT 2**

**8 hours**

Observability and controllability. Minimal realization of MIMO systems. Analysis of linear time varying systems. The concepts of stability.

### **UNIT 3**

**8 hours**

Lyapunov stability analysis. Lyapunov function and its properties. Controllability by state variable feedback.

### **UNIT 4**

**7hours**

Ackerman's Formula - stabilization by output feedback. Asymptotic observers for state measurement. Observer design.

### **UNIT 5**

**6 hours**

State space representation of discrete systems. Solution of state equations, controllability and observability. Stability analysis using Lyapunov method.

### **UNIT 6**

**8 hours**

State feedback of linear discrete time systems. Design of observers - MATLAB Exercises.

### **TEXT BOOKS**

- 1.M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997
2. C.T. Chen, "Linear System Theory and Design", New York: Holt Rinehart and Winston ,1984
3. R.C. Dorf, and R. T. "Bishop, Modern Control Systems", Addison Wesley Longman Inc., 1999.

### **REFERENCES**

1. Thomas Kailath, "Linear Systems", Prentice Hall Inc., Englewood Cliffs, N.J. 1980.
2. K. Ogata, "State Space Analysis of Control Systems", Prentice Hall Inc., Englewood Cliffs, N.J., 1965.
- 3.K. Ogata, "Modern Control Engineering, (second edition)" , Prentice Hall Inc., Englewood Cliffs, N.J., 1990

Course Coordinator

HOD

**OPEN ELECTIVE**

<b>P18OEBA001</b>	<b>BUSINESS ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Pre requisite– NIL				
	Course Coordinator: Dr.S.Praveen Kumar Department: BA				
<b>COURSE OBJECTIVES:</b>					
<ol style="list-style-type: none"> <li>1. Understand the role of business analytics within an organization.</li> <li>2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.</li> <li>3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.</li> <li>4. To become familiar with processes needed to develop, report, and analyze business data.</li> <li>5. Use decision-making tools/Operations research techniques.</li> <li>6. Mange business process using analytical and management tools.</li> <li>7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.</li> </ol>					

#### **UNIT 1**

**9 Hours**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

#### **UNIT 2**

**9 Hours**

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression, Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

#### **UNIT 3**

**9 Hours**

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

#### **UNIT 4**

**9 Hours**

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor, Model, Overbooking Model, Cash Budget Model.

#### **UNIT 5**

**5 Hours**

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The values of Information, Utility and Decision Making.

**UNIT 6**

**4 Hours**

Recent Trends in: Embedded and collaborative business intelligence, Visual 4 data recovery, Data Storytelling and Data journalism.

**Total No. of Periods: 45**

**REFERENCES**

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

<b>P18OEME002</b>	<b>INDUSTRIAL SAFETY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Pre requisite– NIL				
	Course Coordinator: Dr.Balasubramanian Department: Mech				
<p><b>COURSE OBJECTIVES:</b></p> <ol style="list-style-type: none"> <li>1. To study about the industrial safety and types.</li> <li>2. To know about the tools and fundamentals of maintenance.</li> <li>3. To study about the methods of wear and corrosion and their prevention</li> <li>4. To know about the importance of fault tracing and its concepts.</li> <li>5. To learn about the periodic and preventive maintenance of safety.</li> </ol>					

**UNIT 1 Industrial safety**

**9 Hours**

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 2 Fundamentals of maintenance engineering**

**9 Hours**

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 3 Wear and Corrosion and their prevention**

**9 Hours**

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 4      Fault tracing****9 Hours**

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 5      Periodic and preventive maintenance****9 Hours**

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 No. of Periods: 45****REFERENCES**

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

<b>P18OEMA003</b>	<b>OPERATIONS RESEARCH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Pre requisite– NIL				
	Course Coordinator: Dr. Manimegalai      Department: Mathematics/AIC				

**COURSE OBJECTIVES:**

1. To apply the dynamic programming to solve problems of discrete and continuous variables.
2. To apply the concept of non-linear programming.
3. An ability to carry out the sensitivity analysis.
4. An ability to model the real world problem and simulate it.

**UNIT 1****9 Hours**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

**UNIT 2****9 Hours**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

**UNIT 3****9 Hours**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem -max flow

problem - CPM/PERT

**UNIT 4**

**9 Hours**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

**UNIT 5**

**9 Hours**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

**Total No. of Periods: 45**

**REFERENCES**

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010

<b>P18OEBA004</b>	<b>COST MANAGEMENT OF ENGINEERING PROJECTSs</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 35	3	0	0	3
	Pre requisite– NIL				
	Course Coordinator:                      Department: Management/AICTE				

**UNIT 1**

**9 hours**

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

**UNIT 2**

**10 hours**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

**UNIT 3 10 hours**

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

**UNIT4**

**6 hours**

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

**Total No. of Periods: 35 Hours**

**REFERENCES**

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

<b>P18OEME005</b>	<b>COMPOSITE MATERIALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Coordinator:		Department: Mechanical Engineering/AICTE		

**UNIT 1 Introduction**

**9 Hours**

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

**UNIT 2 Reinforcements**

**9 Hours**

Preparation-layup, curing, properties and applications of glassfibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

**UNIT 3 Manufacturing of Metal Matrix Composites**

**9 Hours**

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

**UNIT 4 Manufacturing of Polymer Matrix Composites**

**9 Hours**

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

**UNIT 5 Strength**

**9 Hours**

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro thermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**Total No. of Periods: 45**

**TEXT BOOKS**

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

**REFERENCES**

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen

<b>P18OEEE006</b>	<b>WASTE TO ENERGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Coordinator: Dr.K.Sakthivel                      Department: EEE				

**UNIT 1**

**9 Hours**

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

**UNIT 2**

**9 Hours**

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

**UNIT 3**

**9 Hours**

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 4**

**9 Hours**

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.

**UNIT5**

**9 Hours**

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyand 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.

## 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, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

## Audit I& Audit II

<b>P18ACEN001</b>	<b>AUDIT : ENGLISH FOR RESEARCH PAPER WRITING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator: Department: AICTE				
<p><b>COURSE OBJECTIVES:</b> Students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand that how to improve your writing skills and level of readability</li> <li>• Learn about what to write in each section</li> <li>• Understand the skills needed when writing a Title</li> </ul>					

### UNIT 1

**4 Hours**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

### UNIT 2

**4 Hours**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

### UNIT 3

**4 Hours**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

### UNIT 4

**4 Hours**

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 5

**4 Hours**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions.

**UNIT 6**

**4 Hours**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

**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. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

<b>P18ACCE002</b>	<b>AUDIT: DISASTER MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator:                      Department: AICTE				
<p><b>COURSE OBJECTIVES:</b>            Students will be able to:</p> <ol style="list-style-type: none"> <li>1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.</li> <li>2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.</li> <li>3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.</li> <li>4. Critically 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.</li> </ol>					

**UNIT 1            Introduction**

**4 Hours**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

**UNIT 2            Repercussions of Disasters and Hazards**

**4Hours**

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 3            Disaster Prone Areas in India**

**4 Hours**

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 4 Disaster Preparedness and Management 4 Hours**

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 5 Risk Assessment 4 Hours**

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.

**UNIT 6 Disaster Mitigation 4 Hours**

Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

**REFERENCES**

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ""New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

<b>P18ACEN003</b>	<b>SANSKRIT FOR TECHNICAL KNOWLEDGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator: Department: AICTE				

**COURSE OBJECTIVES:**

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning of Sanskrit to improve brain functioning.
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

**UNIT 1 8 Hours**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

**UNIT 2 8 Hours**

Order, Introduction of roots, Technical information about Sanskrit Literature

**UNIT 3****8 Hours**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

**REFERENCES**

1. “Abhyaspustakam” – Dr.Vishwas, Sanskrit-Bharti Publication,New Delhi
2. “Teach Yourself Sanskrit” PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

**COURSE OUTPUT**

Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood.
- Being a logical language will help to develop logic in students

<b>P18ACBA004</b>	<b>VALUE EDUCATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator: Department: AICTE				

**COURSE OBJECTIVES:**

Students will be able to

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

**UNIT 1****4 Hours**

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

**UNIT 2****6 Hours**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

**UNIT 3****6 Hours**

Personality and Behavior Development - 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. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

**UNIT 4****6 Hours**

Character and Competence –Holy books vs Blind faith. 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.

**REFERENCES**

- Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

**COURSE OUTCOMES**

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

<b>P18ACLW005</b>	<b>CONSTITUTION OF INDIA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator: Department: AICTE				
<p><b>COURSE OBJECTIVES:</b> Students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.</li> <li>• 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.</li> <li>• 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.</li> </ul>					

**UNIT 1 History of Making of the Indian Constitution 4 Hours**

History Drafting Committee, (Composition& Working)

**UNIT 2 Philosophy of the Indian Constitution 4 Hours**

Preamble, Salient Features

**UNIT 3 Contours of Constitutional Rights & Duties 4 Hours**

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 4 Organs of Governance 4 Hours**

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers Judiciary, Appointment and Transfer of Judges,

Qualifications, Powers and Functions.

**UNIT 5 Local Administration**

**4 Hours**

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**UNIT 6 Election Commission**

**4 Hours**

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.

**REFERECES**

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.

**COURSE OUTCOMES**

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- 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.
- Discuss the passage of the Hindu Code Bill of 1956.

<b>P18ACBA006</b>	<b>PEDAGOGY STUDIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 16	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator: Department: AICTE				
<b>COURSE OBJECTIVES:</b> Students will be able to: <ul style="list-style-type: none"><li>✓ Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.</li><li>✓ Identify critical evidence gaps to guide the development.</li></ul>					

**UNIT 1 Introduction and Methodology**

**4 Hours**

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

**UNIT 2 Thematic overview 2 Hours**

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

**UNIT 3 Evidence on the effectiveness of pedagogical 4 Hours**

Methodology for the in depth stage: quality assessment of included studies. How can 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 4 Professional development 4 Hours**

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 5 Research gaps and future directions 2 Hours**

Research design, Contexts, Pedagogy Teacher education, Curriculum and assessment, Dissemination and research impact.

**REFERENCES**

- ✓ Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
- ✓ Agrawal M (2004) curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

<b>P18ACYO007</b>	<b>AUDIT: STRESS MANAGEMENT BY YOGA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator:		Department: AICTE		
<p><b>COURSE OBJECTIVES:</b></p> <ul style="list-style-type: none"> <li>• To achieve overall health of body and mind</li> <li>• To overcome stress</li> </ul>					

**UNIT 1 8 Hours**

Definitions of Eight parts of yog. (Ashtanga )

**UNIT2**

Yam and Niyam.

Do's and Don't's in life i) Ahinsa, satya, astheya, bramhacharya and aparigraha,ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

### UNIT 3

**8 Hours**

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayama

### REFERENCES

‘Yogic Asanas for Group Training-Part-I’ Janardan Swami Yogabhyasi Mandal, Nagpur “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

### COURSE OUTCOMES

Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

<b>P18ACBA008</b>	<b>AUDIT : PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 24	2	0	0	0
	Pre requisite– NIL				
	Course Coordinator: Department: AICTE				
<b>COURSE OBJECTIVES:</b> <ul style="list-style-type: none"><li>• To learn to achieve the highest goal happily</li><li>• To become a person with stable mind, pleasing personality and determination</li><li>• To awaken wisdom in students</li></ul>					

### UNIT 1

**8 Hours**

Neetisatakam-Holistic development of personality

Verses- 19,20,21,22 (wisdom)

Verses- 29,31,32 (pride & heroism)

Verses- 26,28,63,65 (virtue)

Verses- 52,53,59 (don't's)

Verses- 71,73,75,78 (do's)

### UNIT 2

Approach to day to day work and duties.

**8 Hours**

ShrimadBhagwadGeeta : 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.

### UNIT 3

**8 Hours**

Statements of basic knowledge.

ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68

Chapter 12 -Verses 13, 14, 15, 16,17, 18  
Personality of Role model. ShrimadBhagwadGeeta:  
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,  
Chapter 4-Verses 18, 38,39  
Chapter18 – Verses 37,38,63

#### **REFERENCES**

- “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
- Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
- Rashtriya Sanskrit Sansthanam, New Delhi.
- 

#### **COURSE OUTCOMES**

Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity  
Study of Neetishatakam will help in developing versatile personality of students.