GOVT. COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF ELECTRICAL ENGINEERING

CURRICULUM

For

M. TECH. (Electrical Power System)

2019- 2020

Specialization: Electrical Power System

PROGRAM OBJECTIVES

1. TO Work professionally in Electrical power and energy sector
2. To Provide socially acceptable technical solutions through continuous learning and research.
3. To Strengthen managerial skills ethical principles for working in multi disciplinary team to become successful Entrepreneur

PROGRAM OUTCOMES (POs):

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

PO2 Ability to critically analyze and carry out detailed investigation on multifaceted complex Problems in area of Power Systems and envisage advanced research in thrust areas.

PO3 Ability to identify, analyze and solve real-life engineering problems in the area of PowerSystems and provide strategic solutions satisfying the safety, cultural, societal and environmental aspects/ needs.

PO4 Ability for continued pursuance of research and to design, develop and proposetheoretical and practical methodologies towards research and development support for the Power System infrastructure.

PO5 Ability to develop and utilize modern tools for modeling, analyzing and solving various Engineering problems related to Power Systems.

PO6 Willingness and ability to work in a team of engineers/ researchers with mutual understandings to take unsophisticated challenges, in the field of Power Systems, lead and motivate the group to inculcate multidisciplinary and collaborative approach.

PO7 Willingness and ability to take up administrative challenges including the management of various projects of interdisciplinary nature and carry out the same in an efficient manner giving due consideration to societal, environmental, economical and financial factors.

PO8 Ability to express ideas clearly and communicate orally as well as in writing with others in an Effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.

M. Tech. (Electrical Power System)

SEM I													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PCC	EEP121	Power System Analysis	3	--	--	3	30	10	60	-	-	100	3
PCC	EEP122	Power System Modelling	3	--	--	3	30	10	60	-	-	100	3
PCC	EEP123	High Power Converters	3	-	-	3	30	10	60	-	-	100	3
PEC	EEP124	Program Elective I	3	-	-	3	30	10	60	-	-	100	3
LC	EEP125	Laboratory Practice - I		-	6	6	-	-	-	50	50	100	3
LC	EEP126	Seminar I	-	-	4	4	-	-	-	50	-	50	2
SHMC	SHP121	Audit Course	-	-	-	-	-	-	60	-	-	60	0
		Total	**12**	-	**10**	**22**	**120**	**40**	**300**	**100**	**50**	**610**	**17**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE I (EEP 124)
A). Renewable Energy System
B). Smart Grids
C). Mathematical Methods for Power Engineering
D) Advanced Digital Signal Processing
.E) EHV AC Transmission System
F) Any other course approved by BOS

LIST OF AUDIT COURSES

AUDIT COURSES (SHP121)	
(A)English for Research Paper Writing	(B) Disaster Management
(C)Sanskrit for Technical Knowledge	(D)Value Education
(E)Pedagogy Studies	(F) Stress Management by Yoga
(G)Personality Development through Life Enlightenment Skills.	

M. Tech. (Electrical Power System)

SEM II

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PCC	EEP221	Digital Protection	3	--	--	3	30	10	60	-	-	100	3
PCC	EEP222	Power System Dynamics and Stability	3	--	--	3	30	10	60	-	-	100	3
PCC	EEP223	HVDC and FACTS	3	-	-	3	30	10	60	-	-	100	3
PEC	EEP224	Program elective II	3	-	-	3	30	10	60	-	-	100	3
HSMC	SHP221	Research Methodology and IPR	2	-	-	2	30	10	60	-	-	100	2
LC	EEP226	Laboratory Practice - II	-	-	6	6	-	-	-	50	50	100	3
LC	EEP227	Seminar II	-	-	4	4	-	-	-	50	-	50	2
		Total	**14**	**00**	**10**	**24**	**150**	**50**	**300**	**100**	**50**	**650**	**19**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE II (EEP224)
A) Electric and Hybrid Vehicles
B) Electrical Power Distribution System
C) Restructured Power System
D) Power System Transients
.E) Advanced Control System.
F) Any other course approved by BOS

M. Tech. (Electrical Power System)

SEM III*

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PEC	EEP321	Program Elective III	3	-	-	3	10	30	60	-	-	100	3
OEC	SHP321	Open Elective	3	-	-	3	10	30	60	-	-	100	3
PROJ	EEP323	Dissertation Stage I	-	-	20	20	-	-	-	100	-	100	10
		Total	**06**	**00**	**20**	**26**	**20**	**60**	**120**	**100**	**-**	**300**	**16**

***Students going for Industrial Project/Thesis will complete these courses through MOOCs.**

LIST OF PROGRAM ELECTIVES
PROGRAM ELECTIVE III (EEP321)
A) Advanced Electric Drives
B) Power Apparatus Design
C) Power Quality Issues and Mitigation
D) AI and Machine Learning
E) Energy Storage System
F) Any other course approved by BOS

LIST OF OPEN ELECTIVES
OPEN ELECTIVE (SHP321)
(A) Business Analytics (ME)
(B) Industrial Safety (ME)
(C) Operations Research (ME)
(D) Cost management of Engineering Projects (CE)
(E) Composite Materials (CE)
(F) Waste to Energy (CE)
(G) Finance Management (EE)
(H) Project Management (EE)
(I) Data Structure and Algorithm
(J) Any other course approved by BOS

SEM IV

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
							Theory		Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	ESE	ICA	ESE		
PROJ	EEP421	Dissertation Stage II	-	-	32	32	-	-	200	200	400	16
	Total		-	-	**32**	**32**	-	-	**200**	**200**	**400**	**16**

Department of Electrical Engineering

Equivalence Scheme

Programme Name:- Electrical Power System

The deviation in existing and revised curriculum structure is more than 50 % and the contents are also reorganized hence exact course-wise equivalence between old scheme and new scheme do not exist. Hence it is proposed to offer courses as per existing structure for back loggers in the first academic year (i.e three examinations, Winter, Summer & Summer term) from which revised curriculum will be implemented. Thereafter remaining students will be absorbed in revised scheme.

Sr. No.	Course code with Name of course(old)		Credit	Course code with Name of course (new)		Credit
1.	EEP105	Lab Practice - I	4	EEP421	Lab Practice - I	3
2.	EEP206	Lab Practice - II	1	EEP323	Lab Practice - II	3
3	EEP106	Seminar- I	4	EEP227	Seminar I	2
4	EEP207	Seminar - II	1	EEP226	Seminar - II	2
5	EEP301	Dissertation Phase - I	10	EEP125	Dissertation Stage I	10
6	EEP401	Dissertation Phase - II	30	EEP126	Dissertation Stage II	16

EEP121 POWER SYSTEM ANALYSIS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives-

Students will be able to:

1. Study various methods of load flow and their advantages and disadvantages
2. Understand how to analyze various types of faults in power system
3. Understand power system security concepts and study the methods to rank the contingencies
4. Understand need of state estimation and study simple algorithms for state estimation
5. Study voltage instability phenomenon

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.

Fault Analysis: Simultaneous faults, open conductors faults, generalized method of fault analysis.

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

Power System Equivalents : WARD REI.equivalents

State Estimation : Sources of errors in measurement,Virtual and Pseudo, Measurement, Observability, Tracking state estimation, WSL method, bad data correction.

Voltage Stability : Voltage collapse, P-V curve, multiple power flow solution, continuation power flow, optimal multipliés load flow, voltage collapse proximity indices.

Suggested reading

1. J.J. Grainger &W.D.Stevenson, "Power system analysis ", McGraw Hill ,2003
2. A. R. Bergen & Vijay Vittal , "Power System Analysis" ,Pearson , 2000
3. L.P. Singh , "Advanced Power System Analysis and Dynamics", New Age International, 2006
4. G.L. Kusic, "Computer aided power system analysis" ,Prentice Hall India, 1986
5. A.J. Wood, " Power generation, operation and control" , John Wiley, 1994
6. P.M. Anderson, "Faulted power system analysis" , IEEE Press , 1995

Course outcomes-

Students will be able to:

1. Able to calculate voltage phasors at all buses , given the data using various methods of load flow
2. Able to calculate fault currents in each phase
3. Rank various contingencies according to their severity
4. Estimate the bus voltage phasors given various quantities viz.power flow, voltages, taps , CB status etc
5. Estimate closeness to voltage collapse and calculate PV curves using continuation power flow

EEP122 POWER SYSTEM MODELLING

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:- Students will be able to:
1. Study analysis of electromechanical machines
2. Development of mathematical models for synchronous machine
3. Modelling of induction motor

Principle of unified machine theory, generalized torque equation, performance evaluation of DC machine and speed control, three phase induction motor- transformation methods, stationary, rotor and synchronous frames and corresponding equivalent circuits, three phase synchronous motor: representation, Park transformation EHV AC and HVDC Transmission line modelling, Modelling of power system loads (Basic load modelling concepts)

References:

1. P. C. Krause, "Analysis of Electric Machinery", McGraw Hill, New York, 1987.

2. Chee Mun Ong, "Dynamic simulation of Electrical Machinery using Matlab/Simulink" Prentice Hall PTR, 1997.

3. P. Vas, "Vector Control of A.C. Machines", Clarendon Press, Oxford 1990.

4. J .M. D. Murphy and F.G. Turnbull, "Power Electronic Control of AC motors", Pergamum Press, 1988.

5. W. Leonhard, "Control of Electrical Drives", Springer Verlag, 1985.

Course Outcomes:
Students will be able to:
1. Analyze electromechanical devices and machines

2. Use reference frame theory to study and analyze the behavior of induction and synchronous machines

3. Calculate the machine inductances for use in machine analysis

4. Model the electrical machine from the terminal junction with transmission systems

EEP123 HIGH POWER CONVERTERS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:- Students will be able to:

1. Understand the requirements of high power rated converters
2. Understand the different topologies involved for these converters
3. Able to understand the design of protection circuits for these converters

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

Phase shifting transformers, multilevel voltage source inverters: two level voltage source inverter, cascaded, H bridge multilevel inverter.

Diode clamped multilevel inverters, flying capacitor multilevel inverter
PWM current source inverters, DC to DC switch mode converters

AC voltage controllers : Cyclo-converters, matrix converter, Power conditioners and UPS.

Design aspects of converters, protection of devices and circuits

Suggested reading:

1. N. Mohan, T. M. Undeland and W. P. Robbins, "Power Electronics: Converter, Applications and Design", John Wiley and Sons, 1989
2. M.H. Rashid, "Power Electronics", Prentice Hall of India, 1994
3. B. K .Bose, "Power Electronics and A.C. Drives", Prentice Hall, 1986
4. Bin Wu, "High power converters and drives", IEEE press, Wiley Enter science

Course Outcomes:-

Students will be able to:

1. Learn the characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems
2. Knowledge of working of multi-level VSIs, DC-DC switched mode converters, cyclo- converter and PWM techniques and the ability to use them properly
3. Acquire knowledge of power conditioners and their applications
4. Ability to design power circuit and protection circuit of PSDs and converters

EEP124 PROGRAM ELECTIVE-I
A) RENEWABLE ENERGY SYSTEMS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:- Students will be able to:

1. To learn various renewable energy sources
2. To gain understanding of integrated operation of renewable energy sources
3. To understand Power Electronics Interface with the Grid

Introduction, Distributed vs Central Station Generation, Sources of Energy such as Micro-turbines, Internal Combustion Engines.

Introduction to Solar Energy, Wind Energy, Combined Heat and Power, Hydro Energy, Tidal Energy, Wave Energy, Geothermal Energy, Biomass and Fuel Cells.

Power Electronic Interface with the Grid

Impact of Distributed Generation on the Power System, Power Quality Disturbances

Transmission System Operation, Protection of Distributed Generators

Economics of Distributed Generation, Case Studies

Suggested reading

1. RanjanRakesh, Kothari D.P, Singal K.C, "Renewable Energy Sources and Emerging Technologies", 2nd Ed. Prentice Hall of India ,2011
2. Math H.Bollen, Fainan Hassan, "Integration of Distributed Generation in the Power System", July 2011, Wiley –IEEE Press
3. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators", October 2007, Wiley-IEEE Press.
4. Roger A.Messenger, Jerry Ventre, "Photovoltaic System Engineering", 3rd Ed, 2010
5. James F.Manwell, Jon G.McGowan, Anthony L Rogers, "Wind energy explained: Theory Design and Application", John Wiley and Sons 2nd Ed, 2010

Course Outcomes:- Students will be able to:

1. Knowledge about renewable energy
2. Understand the working of distributed generation system in autonomous/grid connected modes
3. Know the Impact of Distributed Generation on Power System

EEP124 PROGRAM ELECTIVE-I
B) SMART GRIDS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:- Students will be able to:

1. Understand concept of smart grid and its advantages over conventional grid
2. Know smart metering techniques
3. Learn wide area measurement techniques
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

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

Introduction to Smart Meters, Real Time Prizing, 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 .

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)

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

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

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

Suggested reading :

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
3. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, "Smart Grid: Technology and Applications", Wiley 2012
4. Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions " CRC Press
5. A.G.Phadke, "Synchronized Phasor Measurement and their Applications", Springer

Course Outcomes

Students will be able to:

1. Appreciate the difference between smart grid & conventional grid
2. Apply smart metering concepts to industrial and commercial installations
3. Formulate solutions in the areas of smart substations,distributed generation and wide area measurements
4. Come up with smart grid solutions using modern communication technologies

EEP124 PROGRAM ELECTIVE-I
C) MATHEMATICAL METHODS FOR POWER ENGINEERING

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:

1. To understand the relevance of mathematical methods to solve engineering problems.
2. To understand how to apply these methods for a given engineering problem

Vector spaces, Linear transformations, Matrix representation of linear transformation

Eigen values and Eigen vectors of linear operator

Linear Programming Problems, Simplex Method, Duality, Non Linear Programming problems

Unconstrained Problems, Search methods, Constrained Problems

Lagrange method, Kuhn-Tucker conditions, Random Variables, Distributions

Independent Random Variables, Marginal and Conditional distributions, Elements of stochastic processes

Suggested reading :

1. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition, PHI, 1992
2. Erwin Kreyszig, "Introductory Functional Analysis with Applications", John Wiley & Sons, 2004
3. Irwin Miller and Marylees Miller, John E. Freund's "Mathematical Statistics", 6th Edn, PHI, 2002
4. J. Medhi, "Stochastic Processes", New Age International, New Delhi., 1994
5. A Papoulis, "Probability, Random Variables and Stochastic Processes", 3rd Edition, McGraw Hill, 2002
6. John B Thomas, "An Introduction to Applied Probability and Random Processes", John Wiley, 2000
7. Hillier F S and Liebermann G J, "Introduction to Operations Research", 7th Edition, McGraw Hill, 2001
8. Simmons D M, "Non Linear Programming for Operations Research", PHI, 1975

Course Outcomes: -

Students will be able to:

1. Knowledge about vector spaces, linear transformation, eigenvalues and eigenvectors of linear operators
2. To learn about linear programming problems and understanding the simplex method for solving linear programming problems in various fields of science and technology
3. Acquire knowledge about nonlinear programming and various techniques used for solving constrained and unconstrained nonlinear programming problems
4. Understanding the concept of random variables, functions of random variable and their probability distribution
5. Understand stochastic processes and their classification

EEP124 PROGRAM ELECTIVE-II
D) ADVANCED DIGITAL SIGNAL PROCESSING

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:

1. To understand the difference between discrete-time and continuous-time signals
2. To understand and apply Discrete Fourier Transforms (DFT)

Discrete time signals, Linear shift invariant systems,Stability and causality, Sampling of continuous time signals, Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform, Z transform-Properties of different transforms

Linear convolution using DFT, Computation of DFT Design of IIR digital filters from analog filters, Impulse invariance method, Bilinear transformation method

FIR filter design using window functions, Comparison of IIR and FIR digital filters
Basic IIR and FIR filter realization structures, Signal flow graph representations Quantization process and errors, Coefficient quantisation effects in IIR and FIR filters

A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zeroInput limit cycles in IIR filters, Linear Signal Models

All pole, All zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals. Estimation of power spectrum of stationary random signals

Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters

Suggested reading :

1. Sanjit K Mitra, "Digital Signal Processing: A computer-based approach ",TataMc Grow-Hill Edition1998
2. Dimitris G .Manolakis, Vinay K. Ingle and Stephen M. Kogon, "Statistical and Adaptive Signal Processing", Mc Grow Hill international editions. -2000

Course Outcomes:-

Students will be able to:

1. Knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems
2. Study the design techniques for IIR and FIR filters and their realization structures.
3. Acquire knowledge about the finite word length effects in implementation of digital filters.
4. Knowledge about the various linear signal models and estimation of power spectrum of stationary random signals
5. Design of optimum FIR and IIR filters

EEP124 PROGRAM ELECTIVE-II
E) EHV AC TRANSMISSION SYSTEM

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:
1. Understand mechanical aspects of EHVAC transmission
2. Understand modelling and analysis of EHVAC transmission line

Introduction: Engineering aspect and growth of EHV_ AC Transmission line trends and preliminaries, power transferability, transient stability and surge impedance loading. Calculation of line and ground parameters: Resistance, power loss, temperature rise properties of bundled conductors, inductance and capacitance of EHV lines, positive, negative and zero sequence impedance and line parameters for modes of propagations. Voltage gradients of conductor: Charge potential relations for multi-conductor lines, surface voltage gradients on the conductor line, distribution of voltage gradients on subconductors of bundle. Corona in E.H.V. lines – Corona loss formulae- attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona – properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV. Theory of the Travelling and standing waves, Lighting and lighting protection, Over voltage in EHV system covered By switching operations, Power frequency voltage control and over voltage, Insulation Coordination, Design of EHV - AC lines

References:

1. R.D. Begamudre , "EHV AC transmission Engineering." New Academic Science Ltd; 4 edition, 2011

2. S Rao, "EHV -AC & HVDC transmission system enginreering", Khanna Publication,3rd

Course Outcomes:-

Students will be able to:

1. Know the necessity, merits and demerits of EHVAC transmission and mechanical aspects

2. Evaluate the Inductance and capacitance of two conductor and multi conductor lines

3. Analyze the effect of corona, electrostatic field of EHVAC lines

4. Analyze the surface gradient on two conductor and bundle with more than 3 sub conductors

5. Demonstrate EHV AC transmission system components, protection and insulation level for over voltages

EEP125 LAB PRACTICE – I

Teaching Scheme : 06 P + 00 Total 06 **Credit : 03**
Marking Scheme: 50 Internal + 50 External **Total Marks :100**

Minimum two simulation / performance type experiments on each course in the current semester should be performed. Respective Course Coordinators shall submit all details of experiments based on concerned course to the Course Coordinator of this course at the beginning of semester.

Note :
ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

EEP126 SEMINAR – I

Teaching Scheme : 04 P + 00 Total 04 **Credit : 02**
Marking Scheme: 50 Internal **Total Marks :50**

Seminar on any technical subject other than above syllabus

SHP121 AUDIT COURSE

A) ENGLISH FOR RESEARCH PAPER WRITING

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 00**

Marking Scheme: 50 (Internal) **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Ensure the good quality of paper at very first-time submission

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

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

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

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,

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

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

Suggested reading :

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

SHP121 AUDIT COURSE
B) DISASTER MANAGEMENT

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 00**
Marking Scheme: 50 (Internal) **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course objectives:
Students will be able to:

1. demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
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

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

Repercussions Of Disasters And Hazards: 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.

Disaster Preparedness And Management :
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.

Risk Assessment
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

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

Suggested reading :

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, Pardeep Et.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.

SHP121 AUDIT COURSE
C) SANSKRIT FOR TECHNICAL KNOWLEDGE

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 00**
Marking Scheme: 50 (Internal) **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course objectives:

Students will be able to:

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

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

Order, Introduction of roots, Technical information about Sanskrit Literature

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

Suggested reading :

1. "Abhyaspustakam" – Dr.Vishwas, Sanskrit-Bharti Publication,New Delhi

2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Outcomes: -

Students will be able to

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

SHP121 AUDIT COURSE
D) VALUE EDUCATION

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 00**
Marking Scheme: 50 (Internal) **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives

Students will be able to

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

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

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

Personality and Behaviour 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

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality ,Non violence ,Humility, Role of Women. All religions and same message. Mind your Mind ,Self-control. Honesty, Studying effectively

Suggested reading :

1 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

SHP121 AUDIT COURSE
E) PEDAGOGICAL STUDIES

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 00**
Marking Scheme: 50 (Internal) **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

Students will be able to:

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

Introduction and Methodology:

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

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

Evidence on the effectiveness of pedagogical practices, 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.**

Professional development: 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

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

Suggested reading:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell. .
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SHP121 AUDIT COURSE
F) STRESS MANAGEMENT BY YOGA

Teaching Scheme,: 02 L + 00 T Total 02 **Credit : 00**
Marking Scheme: 50 (Internal) **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

Students will be able to:

1. To achieve overall health of body and mind.
2. To overcome stress

Definitions of Eight parts of yog. (Ashtanga)

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

Asan and Pranayam
i) Various yog poses and their benefits for mind & body
ii)Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading:

1. Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to understand:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

SHP121 AUDIT COURSE
G) PERSONALITY DEVELOPMENT THROUGH LIFE ENHANCEMENT SKILLS

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 00**
Marking Scheme: 50 (Internal) **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

Students will be able to:

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

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

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge.

Shrimad Bhagwad Geeta: Chapter2-VerseChapter 12 -Verses 13, 14, 15, 16,17, 18

Personalit y of Role model. Shrimad Bhag

Chapter2-Verses 17, Chapter 3-Verses 36,Chapter 4-Verses 18, 38,39

Chapter18 – Verses 37,38,63

Suggested reading:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes:

Students will be able to understand:

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

EEP221 DIGITAL PROTECTION

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1. Study of numerical relays
2. Developing mathematical approach towards protection
3. Study of algorithms for numerical protection

Evolution of digital relays from electromechanical relays, Performance and operational characteristics of digital protection

Mathematical background to protection algorithms,Finite difference techniques

Interpolation formulae, 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

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, The digital relay as a unit consisting of hardware and software

Sinusoidal wave based algorithms, Sample and first derivative (Mann and Morrison) algorithm. Fourier and Walsh based algorithms

Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm. Walsh function based algorithm. Least Squares based algorithms. Differential equation based algorithms. Traveling Wave based Techniques. Digital Differential Protection of Transformers.Digital Line Differential Protection. Recent Advances in Digital Protection of Power Systems.

Suggested reading

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
4. S.R.Bhide "Digital Power System Protection" PHI Learning Pvt.Ltd.2014

Course Outcomes:-

Students will be able to:

1. Learn the importance of Digital Relays
2. Apply Mathematical approach towards protection
3. Learn to develop various Protection algorithms

EEP222 POWER SYSTEM DYNAMICS AND STABILITY

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1. Study of power system dynamics
2. Interpretation of power system dynamic phenomena
3. Study of various forms of stability

Syllabus Contents:

Basic concepts of dynamical systems and stability, modelling of power system components for stability studies: generators, transmission lines, excitation and prime mover controllers, analysis of single machine and multi-machine systems, small signal angle instability (low frequency oscillations): damping and synchronizing torque analysis, Eigen value analysis, mitigation using power system stabilizers, PSS design for multi-machine systems, small signal angle instability (sub-synchronous frequency oscillations): analysis and counter-measures, transient instability: analysis using digital simulation and energy function method, transient stability controllers.

References:

1. K. R. Padiyar, "Power System Dynamics, Stability and Control", Interline Publishers, Bangalore, 1996.

2. P. Kundur, "Power System Stability and Control", McGraw Hill Inc, New York, 1995.

3. P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 1997.

4. E.W. Kimbark, "Power systems Stability", Vol. I and III.

Course Outcomes:-

Students will be able to:

1. Gain valuable insights into the phenomena of power system including obscure ones.
2. Understand the power system stability problem.
3. Analyze the stability problems and implement modern control strategies.
4. Simulate small signal and large signal stability problems

EEP 223 HVDC AND FACTS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1. To learn the active and reactive power flow control in power system
2. To understand the need for static compensators
3. To develop the different control strategies used for compensation

The concept of flexible AC transmission – reactive power control in electrical power transmission lines, uncompensated transmission line, Introduction to FACTS devices and its importance in transmission Network, Introduction to basic types of FACTS controllers, Shunt Compensation: Methods of Var generation: Thyristor controlled reactor (TCR), Thyristor switched capacitor (TSC), Fixed capacitor- Thyristor controlled reactor (FC-TCR), STATCOM; Series Compensation : Thyristor Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC). Static Synchronous Series Compensator (SSSC), modes of operation, Voltage regulator and Phase Angle Regulator (PAR), Multi functional FACTS controller: The Unified Power Flow Compensator (UPFC); circuit and steady-state characteristic; effect on transmission line compensation; Interline Power Flow Controller (IPFC); circuit and steady-state characteristic; HVDC: Introduction, various possible HVDC configurations, components of HVDC system, operation of 6-pulse and 12-pulse converter, Effect of source inductance, Generation of Harmonics, Design of AC filters and DC filters, HVDC light and HVDC PLUS Series and Parallel operation of converters, Introduction to distribution FACTs devices.

References:

1. K. R. Padiyar , " HVDC Power Transmission System", Wiley Eastern Limited, New Delhi , First Edition 1990.

2. T.J.E. Miller , " Reactive Power Control in Electrical System", John Wiley and Sons, New York , 1982.

3. N.G.Hingorani, "Understanding FACTS :Concepts and Technology of FACTS Systems", IEEE Press, 2000.

4. K.R.Padiyar "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.

5. J.Arrillaga, " High Voltage Direct Current Transmission", Peter Pregnnus, London 1983.

Course Outcomes: -

Students will be able to:

1. Acquire knowledge about the fundamental principles of Passive and Active Reactive PowerCompensation Schemes at Transmission and Distribution level in Power Systems.
2. Learn various Static VAR Compensation Schemes like Thyristor /GTO Controlled Reactive Power Systems, PWM Inverter based Reactive Power Systems and their controls.
3. To develop analytical modeling skills needed for modeling and analysis of such Static VARSystems.

EEP224 PROGRAM ELECTIVE-II
A) ELECTRIC AND HYBRID VEHICLES

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1. To understand upcoming technology of hybrid system
2. To understand different aspects of drives application
3. Learning the electric Traction

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

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

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

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

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

Suggested reading :

1.Sira -Ramirez, R. Silva Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer.

2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, "Sliding mode control of switching Power Converters"

Course Outcomes :-

Students will be able to:

1. Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2. To learn electric drive in vehicles / traction.

EEP224 PROGRAM ELECTIVE-II
B) ELECTRICAL POWER DISTRIBUTION SYSTEM

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100.**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1. Learning about power distribution system
2. Learning of SCADA System
3. Understanding Distribution Automation

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

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

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

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

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

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

Suggested reading :

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", CRC Press

Course Outcomes :-Students will be able to:

1. Knowledge of power distribution system
2. Study of Distribution automation and its application in practice
3. To learn SCADA system

EEP224 PROGRAM ELECTIVE-III
C) RESTRUCTURED POWER SYSTEMS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:

1. Understand what is meant by restructuring of the electricity market
2. Understand the need behind requirement for deregulation of the electricity market
3. Understand the money, power & information flow in a deregulated power system

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

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

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

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

Developments in India, IT applications in restructured markets

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

Suggested reading :

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 Outcomes: -Students will be able to:

1. Describe various types of regulations in power systems.
2. Identify the need of regulation and deregulation.
3. Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
4. Identify and give examples of existing electricity markets.
5. Classify different market mechanisms and summarize the role of various entities in the market.

EEP224 PROGRAM ELECTIVE-II
D) POWER SYSTEM TRANSIENTS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:
1. Understand and analyze transient phenomenon in power system
2. Use software for analysis of transient phenomenon

Sources of electrical transients, basic concepts, definitions, causes, effects, basic mathematical concepts for transient analysis, Laplace transform and differential equations, representation of transient wave shapes, modelling power apparatus for transient analysis, capacitor switching, reactor switching, magnetizing inrush and ferroresonance, transmission lines, the wave equation, and line terminations, travelling wave attenuation and distortion, transients due to faults, electromagnetic induction, magnetic flux, and currents, transient electromagnetic phenomena, lightning induced transients, computation of lightning events, lightning protection using shielding and surge arresters, transient voltages and grounding practices, numerical simulation of electrical transients, simulation tools, international standards.

References:

1. Pritindra Chaudhari, "Electromagnetic transients in Power System", PHI.

2. J.C. Das, "Transients in Electrical Systems", McGraw-Hill, 2010.

3. A. Greenwood, "Electrical Transients in Power Systems", Wiley-Interscience, 1991.

4. L. van der Sluis, "Transients in Power Systems", Wiley, 2001.

5. J.A. Martinez-Velasco, "Power System Transients: Parameter Determination", CRC Press, 2009.

6. L.V. Bewley, "Traveling Waves on Transmission Systems".

7. H. W. Dommell, EMTP Theory Book.

8. Alternate Transients Program Rule Book.

Course Outcomes :-Students will be able to:
1. Define, classify, interpret and model the transient phenomena in power system.

2. Simulate the transients using PSCAD, EMTP/ATP software.

3. Analyze transient phenomena and develop the strategies to mitigate associated problems.

4. Evaluate the transient process due to lightning.

EEP224 PROGRAM ELECTIVE-II
E) ADVANCED CONTROL SYSTEM

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:
1 Analyze and design linear dynamic system
2 Analyze digital control system

Review of Linear Algebra : Vector space, linear combination, linear independence, bases of a vector space, representation of any vector on different basis, matrix representation of a linear operator, change of basis, rank, nullity, range space and null space of a matrix, Eigen value and Eigen vector of a matrix, similarity transform, Diagonalization.
Linear System analysis in state space: Controllability, Observability and Stability, Luapunov stability analysis of SISO and MIMO linear systems, Minimal realizations and co-prime fractions.
Control Design: State feedback controller by pole placement and design of observer for linear systems, Design of PI/PID controller
Optimal Control: Formulation of optimal control problem, linear quadratic regulator (LQR)
Non-linear Systems: Introduction to nonlinear systems, phase plane and describing function methods for analysis of linear systems and linearization,
Digital Control System: Discrete time systems, discretization, sampling, aliasing, choice of sampling frequency, ZOH equivalent

References:

1. Chi-Tsong Chen,"Linear System Theory and Design", Oxford University Press.
2. John S. Bay,"Linear System Theory".
3. Thomas Kailath," Linear System", Prentice Hall, 1990
4. Gillette,"Computer Oriented Operation Research", Mc-Graw Hill Publications.
5. K. Hoffman and R. Kunze,"Linear Algebra", Prentice-Hall (India), 1986.
6. G.H. Golub and C.F. Van Loan,"Matrix Computations", North Oxford Academic, 1983.
7. H. K. Khalil,"Nonlinear Systems", Prentice Hall, 2001.
8. K. Ogata,"Discrete Time Control Systems", Prentice hall, 1995.

Course Outcomes :-Students will be able to:
1. Analyze linear control system using vector spaces.
2. Design linear control system using state space to achieve desired system performance
3. Design Linear quadratic regulator to achieve desired system performance
4. Analyze non- linear systems
5. Obtain discrete representation of LTI systems

SHP221 RESEARCH METHODOLOGY AND IPR

Teaching Scheme : 02 L + 00 T Total 02 **Credit : 02**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Unit 1: 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: Effective literature studies approaches, analysis Plagiarism, Research ethics

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: 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: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: 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.

Suggested reading

1 .Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"

4.Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

5.Mayall , "Industrial Design", McGraw Hill, 1992.

6.Niebel , "Product Design", McGraw Hill, 1974.

7.Asimov , "Introduction to Design", Prentice Hall, 1962.

8.Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes:

At the end of this course, students will be able to

1.Understand research problem formulation

2.Analyze research related information

3.Follow research ethics

4.Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

5.Understanding that when IPR would take such important place in growth of individuals nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

6.Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefit

EEP226 LAB PRACTICE – II

Teaching Scheme : 06 P + 00 Total 06 **Credit : 03**
Marking Scheme: 50 Internal + 50 External **Total Marks :100**

Minimum two simulation / performance type experiments on each course in the current semester should be performed. Respective Course Coordinators shall submit all details of experiments based on concerned course to the Course Coordinator of this course at the beginning of semester.

Note :
ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

EEP227 SEMINAR – II

Teaching Scheme : 04 P + 00 Total 04 **Credit : 02**
Marking Scheme: 50 Internal **Total Marks :50**

Seminar on any technical subject other than above syllabus

EEP321 PROGRAM ELECTIVE-III
A) ADVANCED ELECTRIC DRIVES

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:

1. Understand the operation of power electronic converters and their control strategies.
2. Understand the vector control strategies for ac motor drives
3. Understand the implementation of the control strategies using digital signal processors.

Module 1: Power Converters for AC drives (10 hours)
PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

Module 2: Induction motor drives (10 hours)
Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC).

Module 3: Synchronous motor drives (6 hours)
Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

Module 4: Permanent magnet motor drives (6 hours)
Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

Module 5: Switched reluctance motor drives (6 hours)
Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

Module 6: DSP based motion control (6 hours)
Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

Text / References:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.
3. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.
4. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

EEP321 PROGRAM ELECTIVE-III
B) POWER APPARATUS DESIGN

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:
1. Study the modelling analysis of rotating machine.
2. Learning electromagnetic energy conversion
3. To know about rating of machines

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 per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling

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

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, Forces winding during short circuit

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

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

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

Suggested reading :

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, 5th Edition

Course Outcomes: -

Students will be able to:
1. To give a systematic approach for modeling and analysis of all rotating machines under both transient and steady state conditions with the dimensions and material used
2. Ability to model and design all types of rotation machines including special machines

EEP321 PROGRAM ELECTIVE-III

C) POWER QUALITY ISSUES AND MITIGATION

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Course Objectives: -Students will be able to:

1. Understand the different power quality issues to be addressed
2. Understand the recommended practices by various standard bodies like IEEE,IEC, etc on voltage& frequency, harmonics
3. Understanding STATIC VAR Compensators

Introduction-power quality-voltage quality-overview of power 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.

Harmonics-individual and total harmonic distortion, RMS value of a harmonic waveform, Triplex harmonics-important harmonic introducing devices-SMPS, Three phase power converters, arcing devices saturable devices-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

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, power quality problems created by drives and its impact on drive

Power factor improvement- Passive Compensation, Passive Filtering , Harmonic Resonance Impedance Scan Analysis- Active 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

Static VAR compensators-SVC and STATCOM · Active Harmonic Filtering-Shunt Injection, Filter for single phase, three-phase three-wire and three-phase four- wire systems d-q domain control of three phase shunt active filters uninterruptible power supplies constant voltage transformers, series active power filtering techniques for harmonic cancellation and isolation.

Dynamic Voltage Restorers for sag , swell and flicker problems. Grounding and wiring introduction, NEC grounding requirements-reasons for grounding, typical grounding and wiring problems solutions to grounding and wiring problems

Suggested reading :

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 Outcomes: -

Students will be able to:

1: Acquire knowledge about the harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads

2: To develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components

3: To introduce the student to active power factor correction based on static VAR compensators and

its control techniques

4: To introduce the student to series and shunt active power filtering techniques for harmonics

EEP321 PROGRAM ELECTIVE-III
D) AI AND MACHINE LEARNING

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1. Understanding fuzzy logic, ANN
2. Understanding machine learning and algorithm

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, Fuzzy Logic, Knowledge Representation and Inference Mechanism, Defuzzification Methods, System Identification using Fuzzy and Neural Network

Introduction to Machine Learning: Basic definitions, types of learning, designing a learning system, perspectives and issues, hypothesis space and inductive bias, evaluation, cross-validation. Linear regression, Decision trees, Splitting Criteria, Issues in decision tree learning, over-fitting and evaluation, nearest neighbor methods. Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network. Dimensionality Reduction: Feature reduction, Principal Component Analysis, Fischer's Discriminant Analysis. Probability and Bayes learning, Naive Bayes Model, Logistic Regression, Reinforcement learning. Support Vector Machine, Kernel function and Kernel SVM, Clustering: partitioning, k-means clustering, hierarchical clustering, and Case studies

Suggested reading :

1. J M Zurada , "An Introduction to ANN",Jaico **Publishing** House
2. Simon Haykins, "Neural Networks", Prentice Hall
3. Ethem Alpaydin, "Introduction to Machine Learning", Second Edition, The MIT Press, 2010.
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Course Outcomes: -

Students will be able to:

1. Learn the concepts of biological foundations of artificial neural networks
2. Learn Feedback networks and radial basis function networks and fuzzy logics
3. Identifications of fuzzy and neural network
4. Explain the basic concepts of machine learning
5. Demonstrate fundamental issues and challenges of machine learning algorithms

EEP321 PROGRAM ELECTIVE-III
E) ENERGY STORAGE SYSTEM

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Course Objectives:-Students will be able to:

1 Understand emerging needs of energy storage system

2. Model and analyze energy storage systems

Syllabus Contents:

The Role of Electrical Energy Storage Technologies in Electricity use, emerging needs of Electrical Energy Storage (EES), roles of EES, Types of Electrical Energy Storage Systems, Classification of EES systems, Performance characteristics of energy storage systems, Types of load curves, energy shift, Ragone plot. Importance of energy density and power density. Mechanical, Electrochemical, Chemical, Electrical, Thermal Energy Storage systems, Standards and Safety involved, Areas of applications of EES, Markets and forecast for EES.

References:

1. IEC White paper on Electrical Energy Systems: www.iec.ch/whitepaper/pdf/iecWP

2. Energy Storage Systems, Volume I and II, EOLSS, www. eolssunesco@gmail.com

3. A. G. Ter-Gazarian, "Energy Storage for Power Systems", Institution of Engineering and Technology, 2011.

4. James M. Eyer, Joseph J. Iannucci and Garth P. Corey, "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.

Course Outcomes: -

Students will be able to:

1. Identify the emerging needs of Electrical Energy Storage Systems.

2. Discuss the scientific principles underpinning the operation of energy storage systems

3. Model various electrical energy storage systems and analyze their performance.

4. Assess the global markets for the Electrical Energy Storage Systems

EEP322 OPEN ELECTIVE
A) BUSINESS ANALYTICS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Course Objectives :

1.Understand the role of business analytics within an organization.

2.Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.

3.To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making

4.To become familiar with processes needed to develop, report, and analyze business data.

5.Use decision-making tools/Operations research techniques.

6.Mange business process using analytical and management tools.

7.Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Unit1:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, 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:

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:

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:

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:

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

Unit 6:

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

Suggested reading :

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.

Course outcome :

1.Students will demonstrate knowledge of data analytics.

2.Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.

3.Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

4 Students will demonstrate the ability to translate data into clear, actionable insights

EEP322 OPEN ELECTIVE
B) INDUSTRIAL SAFETY

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: 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

Reference:

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.

EEP322 OPEN ELECTIVE
C) OPERATIONS RESEARCH

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

Unit 1:

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

Unit 2

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

Unit 3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

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

Unit 5

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

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
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Outcomes :

At the end of the course, the student should be able to

1. apply the dynamic programming to solve problems of discreet and continuous variables
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

EEP322 OPEN ELECTIVE

D) COST MANAGEMENT OF ENGINEERING PROJECTS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

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.

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

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.

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

Suggested reading :

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 CostAccounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management; Tata McGraw Hill Book Co. Ltd.

EEP322 OPEN ELECTIVE
E) COMPOSITE MATERIALS

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

UNIT–I: INTRODUCTION: 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 – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, 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 – III: Manufacturing of Metal Matrix Composites: 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–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Suggested reading :

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

EEP322 OPEN ELECTIVE
F) WASTE TO ENERGY

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE : 2 Hrs.30 min.

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

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

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Suggested reading :

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.

EEP322 OPEN ELECTIVE
G) FINANCE MANAGEMENT

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Financial Management, objectives and goals, Fixed Capital, Floating Capital, Fund flow analysis and Fund flow statements. Ratio analysis: Classification, structural group, standards for comparison and limitations

Profit planning and Break-even analysis, margin of safety. Financial Budgets, control measures, Authorized capital, working capital, reserve, capital Management, floating of shares, share capitals & fund raising –methods and their appraisal.

Control measures– Payback approach, Standard costing, Actual costing, Operating ratio, techniques of cost control, Marginal cost.

Elements of Costs: Material, Labor, Expenses, Overheads, Direct and Indirect Cost, Fixed and Variable Cost, other classifications. Allocation of overheads Methods for Depreciation calculation, Budgetary control and Variance analysis, Activity based costing (ABC). Biases in cash flow estimation.

Appraisal criteria: Net Present Value, benefit cost ratio, internal rate of returns urgency, payback period, accounting rate of returns, investment appraisal in practice

Analysis of Risk, Types and measure of risk , simple estimation of risk, sensitivity analysis, scenario analysis, Special decision situations: Choice between mutually exclusive projects of unequal life, optimal timing decision, determination of economic life, inter-relationships between investment and financing aspects, inflation and capital budgeting. Analysis of firm and market risk:

Portfolio theory and capital budgeting, Capital Asset Pricing Model.

Suggested reading :

1. J Pandey I M., Financial Management, Vikas Publication, 10th Edition 2013
2. Henry M. Stenier, "Engineering economics Principles", Mc Graw Hill Publication.
3. C. B. Gupta, "Fundamentals of Business", Sultan Chand & Company.
4. S. K. Basu, K.C. Sahu and Rajiv B, "Industrial Organisation and Management", PHI New Delhi, Nov 2012.

EEP322 OPEN ELECTIVE
H) PROJECT MANAGEMENT

Teaching Scheme : 03 L + 00 T Total 03 **Credit : 03**

Marking Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks :100**

Duration of ESE : 2 Hrs.30 min.

Introduction: Human Factors and Systems, Information Input and Processing, Visual Displays of Dynamic Information, Human Output and Control: Physical Work and Manual Materials Handling, Motor Skills, Human Control of Systems, Hand Tools and Devices.

Definition of Ergonomics and its significance in designing workplace layout and detailed motion plan of work, Man-Machine Symbiosis, Human Factors in design & manufacturing, Viz. pressure of the environment, temperature, humidity etc., Principles of motion economy, anthropometric condition, stability criterion etc. Biodynamic analysis for design of products & its concept of learning by man and machine;

Measurement of Learning Index and training for each job and each man, Product design – various aspects including ergonomic design and reliability based design.

Dynamic consideration in design of product using vibration stability in biomechanisms. Safety in manufacturing. Considerations of human stress, Allowable limit of stress, stress adjustment.

Estimation of human error and human reliability, combining various forms of human error by random number simulation, Human Error, Accidents and safety, Human Factors and the Automobile, Human Factors in Systems Design.

Dynamic consideration in project operations, leadership, requirement, communication process, motivating a diverse workflow, facilitating team decisions, resolving interpersonal conflicts, managing different people, strengthening team accountability

Suggested reading :

1. Sanders, M.M. & Mc Cormick, E.J., Human Factors in Engineering & Design, McGraw-Hill, 7th ed. (1993)

2. S. K. Basu, K.C. Sahu and Rajiv B, Industrial Organisation and Management –, PHI New Delhi, Nov 2012.

EEP323 DISSERTATION PHASE I

Teaching Scheme : 20 P + 00 Total 20 **Credit: 10**
Evaluation Scheme : 100 Internal **Total Marks: 100**

Dissertation topic selection and seminar on scope & plan of the work
Student has to submit the report and deliver the seminar based on state of the art, literature survey, problem definition and preliminary work . It is to be evaluated & approved internally by three member's panel of examiners headed by HOD wherein guide should be one of the members of the panel. Last date of submission of report shall be two weeks before the end of semester

EEP421 DISSERTATION PHASE II

Teaching Scheme : 32 P + 00 Total 32 **Credit : 16**
Evaluation Scheme : 200 Internal +200 External **Total Marks :400**

Final dissertation and final seminar on complete work

Dissertation (Phase-II): Internal assessment of dissertation (complete work) is to be carried out by the guide for 100 Marks. External assessment of Dissertation (complete work) is to be carried out by panel of examiner consisting of internal (guide) and external examiner for 200 marks. Candidate shall present the entire work on Dissertation, followed by viva-voce. Please see Appendix-C of Rules & Regulation for Further information.

Note: (EEP321) Dissertation Phase I is prerequisite for (EEP421) Dissertation Phase II