Indira Gandhi University, Meerpur, Rewari

NEW SCHEME OF STUDIES AND EXAMINATION
(w.e.f. 2021-22)
B-TECH 4th YEAR (ELECTRICAL ENGINEERING)
SEMESTER-VII

Sl. No.	Course Code	Course Title	Teaching Schedule L	T	P	Examination Schedule (Marks) Internal Assessment	Theory	Practical	Total	Credit	Duration of Exam (Hours)
1.	Refer to Table-1	Program Elective -IV	3	0	0	25	75	0	100	3	3
2.	Refer to Table-1I	Program Elective -V	3	0	0	25	75	0	100	3	3
3	Refer to Table-V	Program Elective –VI	3	0	0	25	75	0	100	3	3
4	Refer to Table-III	Open Elective-III	3	0	0	25	75	0	100	3	3
5	Refer to Table-IV	Open Elective-IV	3	0	0	25	75	0	100	3	3
6	HSMC -08	Fundamentals of Management	2	0	0	25	75	0	100	2	2
7	SEM-EE-424	Seminar	0	0	1	25	0	25	50	1	-
8	INT –EE-425	Evaluation of Summer Internship	0	0	1	-	-	-	-	-	-
Total						175	450	25	650	18	

Note: 1. The evaluation of Summer Internship will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat.

2. Choose any one subject from TABLE-I
3. Choose any one subject from TABLE-II
4. Choose any one subject from TABLE-III
5. Choose any one subject from TABLE-IV
6. Choose any one subject from TABLE-V

TABLE-1
PROGRAM ELECTIVE LIST (Program Elective -IV)

S. No.	Course Code	Title of the Course
1.	PEC-EE-401	Power management
2.	PEC-EE-403	Electrical Engineering Drawing
3.	PEC-EE-405	Utilization of Electrical Power
4.	PEC-EE-407	Advanced Power Electronics
5.	PEC-EE-409	Power System Planning and Reliability

TABLE-1I
PROGRAM ELECTIVE LIST (Program Elective -V)

S. No.	Course Code	Title of the Course
1.	PEC-EE-411	Modelling and Analysis of Electrical Machines
2.	PEC-EE-413	Microcontroller Based System Design
3.	PEC-EE-415	Advanced Power Transmission
4.	PEC-EE-417	Computer Aided Power System Analysis

TABLE-III
PROGRAM ELECTIVE LIST FOR VII SEM (Program Elective –VI)

S. No.	Course Code	Title of the Course
1.	PEC-EE-402	Special Electrical Machines
2.	PEC-EE-404	Applications of Power Electronics in Power Systems
3.	PEC-EE-406	Power System Stability
4.	PEC-EE-408	Advanced Control Systems
5.	PEC-EE-410	Advances in Power Transmission & Distribution

TABLE-IV
OPEN ELECTIVE LIST FOR VII SEM (Open Elective-III)

S. No.	Course Code	Title of the Course
1	OEC-EE-401	Intelligent Systems & Control
2	OEC-EE-403	Renewable Energy and distributed generation
3	OEC-EE-405	Reliability engineering
4	OEC-CE- 448	Traffic Engineering and Road Safety
5	OEC-ME-410	Quality Engineering

TABLE-V
OPEN ELECTIVE LIST FOR VII SEM (Open Elective-IV)

S. No.	Course Code	Title of the Course
1	OEC-EE-407	Solar Photovoltaic Technology
2	OEC-EE-409	Energy Conservation and Management
3	OEC-CE- 450	Disaster Management
4	OEC-ECE-451	Electronic Principles
5	OEC-MATH-405	Advance Engineering Mathematics
6	OEC-CSE-430	Computer Communication

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NEW SCHEME OF STUDIES AND EXAMINATION
(w.e.f. 2021-22)
B-TECH 4th YEAR (ELECTRICAL ENGINEERING)
SEMESTER-VIII

Sl. No.	Course Code	Course Title	Teaching Schedule L	T	P	Examination Schedule (Marks) Internal Assessment	Theory	Practical	Total	Credit	Duration of Exam (Hours)
1.	INTPR-EE-402	Industrial Training	0	0	6	200	0	300	500	10	3
Total						200		300	500	10	

2 Hours per week per batch for one teacher and batch size will be decided by the HOD/Chairperson of the department.

Procedure for Examination and continuous Assessment

(A) External Exam Marks

1. Project Evaluation 100 Marks
2. Project Seminar 100 Marks
3. Project Viva 100 marks

(B) Continuous Assessment Marks

1. Assessment by Internal Examiner and Viva (Before the Committee Constituted by Chairman of the Department) 150 Marks
2. Assessment by Industrial Guide 50 Marks

Course code	PEC-EE-401				
Category	Program Elective Course				
Course title	**Power Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit.Thestudentshavetoattemptfivequestionsintotal,firstbeingcompulsory andselectingonefromeachunit.

Course Outcomes:

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

- Know about the present power scenario ofIndia.
- Know about the general layout of various engineeringequipments.
- Know theoretically and practically about power utilities ofHaryana.
- Know about various risks and hazards in the concernarea.

SECTION-A

INTRODUCTION: Power Scenario, Power Development, Planning, Power resources, Environment Power matters Plan, Pre-feasibility and feasibility studies, State relations for Poweretc.

RESOURCES: Resources, Geophysical study, Seismic Considerations, Environmental Restraints, Resettlement and Rehabilitation.

SECTION-B

PROCUREMENT: Contracting and Procurement, Consulting Services, Types of Contracts, Project Management, Organization and Economy Management, Organizational Planning and Time Scheduling, Project Cost Control.

ENGINEERING: Engineering & General Layout of Equipments, Generator, Transformer and Switch Gear and Control Equipment, Construction Methods, Operation and Maintenance Principle, Maintenance organization and planning, Availability, life cycle cost & future development. Visits to sites.

SECTION-C

POWER SECTOR: Power sector structure in different states, Regulatory Regime in those states, Power utilities in Haryana, Grid management, Power financing, Visit to sites.

POWER STATION: Management of Fuel, water Resource Electricity deviend scenario storage and handling, Pricing, Contract etc., Human resource management. Visit to sites.

SECTION-D

RISK & HAZARD: Introduction to risk, rules and regulation Aspects of Risk & Hazard Health & risk assessment visit to site.

ELECTRICITY INDUSTRY STRUCTURE & SAFETY REGULATIONS BILL & ETC.: State and Central Power boards / Power corporations.

Text / Reference Books:

1. Electricity Bill, Safety & ConservationAct
2. Arora & Dom Kundwar, A Course in Power Plant Engineering, Pub.: Dhanpat RaiPub, 2000.
3. Jain &BalaSubranmanyam, “Power Plant Engineering”, Dhanpat RaiPub.,
4. Butter Worth, A.B. Gill, “Power Plant Performance Management”, Pub:1984.
5. P.C. Sharma, “Power Plant Engineering”, Dhanpat RaiPub.,
6. DavidA.Decenzo,StephenP.Robbins,HumanResourceManagement.NewDelhi:PHIPvt.Ltd.,2004.
7. P.K. Nag, Power Plant Engg. N.Delhi: TMH,2003

Course code	PEC-EE-403				
Category	Program Elective Course				
Course title	**Electrical Engineering Drawing**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsoryand selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the basic design and drawing for armature, transformer, d.c. machine, induction motor and synchronous machine and substation individually.
2. Understand the complete detailed design of all static and rotating machines and their performance with problems.
3. Understand to analyze the design procedure and performance of various algorithms.

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Section-A

ARMATURE: Simplex lap/wave dc armature windings, Simplex lap/ wave, integral/ fractional slot, double layer three phase ac armature windings, Single layer three phase ac armature windings.

Section-B

TRANSFORMER: Sectional plan and elevation of a transformer limb with windings, Sectional plan and elevation of the core assembly of a power transformer, Sectional plan and elevation of a distribution transformer tank with its accessories.

Section-C

DC MACHINES: Sectional front and side elevation of armature with commutator, Sectional front and side elevation of yoke and pole assembly with field winding, Sectional front and side elevation of assembled Machine.

ALTERNATORS: Sectional front and side elevation of water wheel rotor assembly with winding, Sectional front and side elevation of salient pole alternator, Sectional front and side elevation of turboalternator.

INDUCTION MOTORS: Sectional front and side elevation of slip ring induction motor, Sectional front and side elevation of squirrel cage induction motor, Experiments using ElectricalCAD.

Section-D

SUBSTATIONS: Layouts and single line diagrams of outdoor and indoor substations, Layout of a 220KV substation, Layout of a captive power substation, Single line diagram of a distribution center.

Text/References:

1. Bhattacharya S.K, Electrical Engineering Drawing, Wiley Eastern, Edition
2. Clayton&Hancock,PerformanceandDesignofDCMachines,ELBS,1992.
3. Narang K.L., A Text Book of Electrical Engineering Drawing, Tech India Publications.
4. A.K. Sawhney, Electrical Machine Design, Dhanpath Rai, New Delhi,1991.
5. Say M.G, Performance and Design of AC machines, Pitman, ELBS, 1991.

Course code	PEC-EE-405				
Category	Program Elective Course				
Course title	**Utilization of Electrical Power**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. This Course provides an introduction to the principles of electrical drives and their applications in dailylife.
2. This course deals with the fundamentals of illumination and itsclassification.
3. Provides knowledge on electrical traction systems

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading condition
2. To acquaint with the different types of heating and weldingtechniques
3. To study the basic principles of illumination and itsmeasurement
4. Tounderstandthebasicprincipleofelectrictractionincludingspeed–timecurvesofdifferenttractionservices

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsoryand selecting one from each Unit.

Section-A

ELECTRIC DRIVES :Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

Section-B

ELECTRIC HEATING & ELECTRIC WELDING: Advantages and methods of electric heating, resistance heating, induction heating, and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding

Section-C

ILLUMINATION

Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Discharge lamps, MV and SV lamps comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

Section-D

ELECTRIC TRACTION

System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking – plugging, rheostatic braking and regenerative braking. Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

TEXT BOOKS:

1. Utilization of Electrical Energy - by E. Opens haw Taylor, UniversityPress.
2. Art & Science of Utilization of Electrical Energy - by Par tab, Dhanpat Ravi & Sons.

REFERENCEBOOKS:

3. Utilization of Electrical Power including Electric drives and Electric traction – by N.V. Suryanarayana, New Age International (P) Limited, Publishers,1996.
4. Generation, Distribution and Utilization of Electrical Energy - by C.L. Wadhwa New Age International (P) Limited, Publishers,1997.

Course code	PEC-EE-407				
Category	Program Elective Course				
Course title	**Advanced Course in Power Electronics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit.Thestudentshavetoattemptfivequestionsintotal,firstbeingcompulsoryandselectingonefromeachunit.

Course Objectives:

1. Toreviewbasicconceptsofpowerelectronicsinthefieldofpowercontrolanddrives.
2. ToaddresstheunderlyingconceptsandmethodsbehindAdvancedPowerElectronics.
3. To impart knowledge of power semiconductor technologies and their advancement in the field of power conversion.

Course Outcomes:

1. Theoretical and practical knowledge on modern daysemiconductor devices, their characteristics and control.
2. Understanding operation and analysis of switched mode DCDC converters and theirdesigning.
3. Knowledge of power conditioners and theirapplication.
4. WorkingknowledgeofstaticapplicationsofadvancedpowerelectronicslikeUPS,HVDC,Automotiveetc.

SECTION-A

Advanced solid state devices such as MOSFETs, IGBT, GTO, IGCT etc, their power modules, intelligent power modules, thermal design, protection, gating circuits, digital signal processors used in their control. non-isolated and isolated dc- dc converters such as buck, boost, buck-boost, flyback,forward, Cuk, SEPIC, Zeta, half bridge, push-pull and bridge in DCM and CCM, single-phase, single-stage converters (SSSSC), power factor correctionatacmainsintheseconverters,theirapplicationinSMPS,UPS,weldingandlightingsystems.

SECTION-B

Improved power quality ac-dc converters such as single-phase buck, boost, buck-boost ac- dc converters, PWM (Pulse width modulated) based single phase, three-phase VSC (Voltage source converters), multilevel VSCs, multipulse VSCs, PWM CSC (Current voltage source converters), multipulse ac-dc converters.power quality mitigation devices such as passive filters, active filters, hybrid filters, DTSTCOM (Distribution static compensator), DVR (Dynamic voltage restorers) and UPQC (Universal power qualityconditioners).

SECTION-C

FACTS devices such TCR (thyristorcontrolled reactor), TSC (thyristor switched capacitors), STATCOM (Static synchronous compensator), SSSC (Static series synchronous compensator),

UPFC (Unified power flow controller), IPFC (Interline power flow controller). HVDC (High voltage direct current) system such as 12-pulse converter based HVDC systems, HVDC light, HVDC PLUS (Power universal link), multipulse and multilevel VSC based flexible HVDCsystems.

SECTION-D

solid state controllers for motor drives such as vector control and direct torque control of induction motor, synchronous motor, permanent magnet sine fed motor, synchronous reluctance motor, permanent magnet brushless dc (PMLDC) motor, LCI (load commutated inverter) fed large rating synchronous motor drives, energy conservation and power quality improvement in thesedrives.

Text / Reference Books:

1. R. S. Ramshaw, "Power Electronics Semiconductor Switches", Champman& Hall,1993.
2. N. Mohan, T. M. Undeland and W. P. Robbins, "PowerElectronics, Converter, Application and Design", Third Edition, John Willey & Sons,2004.
3. M. H. Rashid, "Power Electronics, circuits, Devices andApplications", Pearson, 2002,India.
4. K. Billings, "Switch Mode Power Supply Handbook", McGraw-Hill, 1999,Boston.
5. A. I. Pressman, "Switch Mode Power Supply Design", McGraw-Hill, 1999, NewYork.
6. N. G. Hingorani and L. Gyugyi, "Understanding FACTS", IEEE Press, Delhi,2001.
7. B. K. Bose, "Power Electronics and Variable FrequencyDrive", Standard Publishers Distributors,2000.

8. Bin Wu, “High-Power Converters and AC Drives”, IEEEPress, A John Wiley & Sons, Inc Publication, New York,2006.
9. G. T. Heydt, “Electric Power Quality”, Stars in a CirclePublications, second edition, 1994, Avarua, Rarotonga, Cook Islands.
10. R. C. Duagan, M. F. Mcgranaghan and H. W. Beaty, “Electric Power System Quality”, McGraw-Hill, 2001, 1221 Avenue of the Americas, NewYork.
11. Vijay K. Sood, “HVDC and FACTS Controllers -Applications of Static Converters in Power Systems”, Kluwer Academic Publishers, Masachusetts, 2004.
12. J.Arrillaga,Y.H.LiuandN.R.Waston,“FlexiblePowerTransmission-TheHVDCOptions”,JohnWiley&Sons,
13. Ltd, Chichester, UK, 2007.A joint venture by IISc and IITs, funded by MHRD, Govt of India http://nptel.iitm.ac.in

Course code	PEC-EE-409				
Category	Program Elective Course				
Course title	**Power Systems Planning & Reliability**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. Understand the power system planning objectives
2. Understand the generating system planningissues.
3. Understand the loadforecasting
4. Understand basic concept of reliability

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the concept of power system planning.
2. Evaluate the peak demand and energy requirements of system using forecasting techniques.
3. Understand concepts of Reliability Evaluation of generation, transmission and distribution system.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Introduction: Objectives of planning, Long and short term planning, Planning of generation, transmission and distribution systems. Least Cost Power Planning, Integration of DSM.

Section-B

Load Forecasting: Classification and characteristics of loads. Approaches to load forecasting. Forecasting methodology. Short-run and Long run forecasting. Energy forecasting. peak demand forecasting, total forecasting, annual and monthly peak demand forecasting. Electricity Price Forecasting.

Section-C

Basic Reliability Concepts: General reliability function, exponential distributions, meantime to failure, Markov Chains and processes and their applications, simple series and parallel system models.

Static Generating Capacity Reliability Evaluation: Outage definitions, loss of load probability methods, loss of energy probability method. Frequency and duration methods, load forecasting uncertainty.

Section-D.

Transmission System Reliability Evaluation: Average interruption rate method. LOLP method. The frequency and duration method.

Distribution System Reliability Analysis: distribution network reliability, reliability performance.

Text / References

1. Roy Billington, 'Power System Reliability Evaluation', Gordan& Breach ScainPublishers,1990.
2. Endrenyi, J., 'Reliability modelling in Electric Power System' JohnWiley,1980.
3. Billinton Roy, Allan Ronald, 'Reliability of Power System' PlenumPress,1996.
4. David Elmakias, 'New Computational Methods in Power System Reliability'Springer-Verlag,2008.
5. Ali Chowdhury, Don Koval, 'Power Distribution System Reliability: Practical Methods and Applications, Wiley-IEEEPress,2009.
6. Dasari, S., Electric Power System Planning, IBT Publishers(1999).
7. Pabla, A.S., Electric Power Distribution, Tata McGraw• Hill(2008).–
8. Sullivan, R., Power System Planning, McGraw(1977)
9. Knight, U.G., Power System Engineering and Mathematics, Pergamon Press (1972).
10. McDonald, J.R., Modern Power System Planning, McGraw(2007)

Course code	PEC-EE-411				
Category	Program Elective Course				
Course title	**Modeling and Analysis of Electrical Machines**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the basic principle and operation analysis of rotating machines.

Understand the complete operation of rotating machines and their performance evaluation with problems.

- Understand and analyze the various reference frame and algorithms for electrical machines.

Section-A

BASIC PRINCIPLE OF ELECTRICAL MACHINE ANALYSIS OPERATION AND STEADY STATE BEHAVIOUR OF ELECTRICAL MACHINES: Review on basic magnetic circuits, Electromagnetic energy conversion, Principles of energy flow, Steady state equations of dc machines, rotating field theory, operation of Induction motor, operation of Synchronous motor.

REFERENCE FRAME THEORY: stator and rotor voltage equations and torque equation in different reference frame, linearized machine equations and eigen value analysis.

Section-B

DC MACHINE MODELLING: Mathematical modeling of dc machine (Separately excited, shunt and series type), Elements of generalized theory Basic two pole machine-primitive 2 axis machine, voltage and current relationship, torqueequation

Section-C

INDUCTION MACHINE MODELLING:

Poly phase Induction Machines- Mathematical Modeling of Induction Machines. Voltage and torque equations in machine variables, distributed winding in ac machinery, winding function, air gap mmf, rotating mmf, derivation of induction motor model in rotor flux and stator flux oriented referenceframe.

Section-D

SYNCHRONOUS MACHINE MODELLING: Voltage and torque equation of salient pole synchronous machine including damper winding in stator and rotor reference frame, derivation of steady statemodel.

Text/References:

1. P. C. Krause, OregWasynczuk, Scott D. Sudhoff, "Analysis of Electric Machinery and drive systems" , IEEE Press, 2002.
2. P. S. Bhimbra, "Generalized Theory of Electrical Machines", KhannaPublications.
3. C.V. Jones " Unified theory of Electrical Machines" Butterworth Publishers, Dec1967.

Course code	PEC-EE-413				
Category	Program Elective Course				
Course title	**Microcontroller Based System Design**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. To introduce the architecture of PIC microcontroller
2. To educate on use of interrupts and timers
3. To educate on the peripheral devices for data communication and transfer
4. To introduce the functional blocks of ARM processor

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. To understand and apply computing platform and software for engineering problems.
2. To understand ethical issues, environmental impact and acquire management skills.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

UNIT I INTRODUCTION TO PIC MICROCONTROLLER

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx–- Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

Section-B

UNIT II INTERRUPTS AND TIMER

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

Section-C

UNIT III PERIPHERALS AND INTERFACING

I2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter– UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

Section-D.

UNIT IV INTRODUCTION TO ARM PROCESSOR

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems. 3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set.

Text / References

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition,2004.
2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.
3. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India,2007.

Course code	PEC-EE-415				
Category	Program Elective Course				
Course title	**Advanced Power Transmission**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1.Understand Knowledge of Extra High Voltage AC & DC Transmission System
2.To understand and estimation of transmission line parameters.
3.To obtain the equivalent circuits of the transmission lines for determining voltage regulation and efficiency.
4.To know about the FACTS controllers.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Discuss Modelling of the transmission line parameters.
2. Explain the equivalent circuits for the transmission lines based on distance and determine voltage regulation and efficiency.
3. To deal with the importance of HVDC Transmission and HVDC Converters
4. Knowledge of Modern power controllers to enhance the stability and capability of existing network.
5. Monitoring and improvement of Power Quality

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsoryand selecting one from each Unit.

Section-A

EHV AC Transmission: Need of EHV transmission, standard transmission voltage, electrical and mechanical considerations of EHV lines, surface voltage gradients in conductor, distribution of voltage gradients on sub- conductors, Features of EHV transmission lines.

Section-B

HVDC Transmission: DC links, components and configurations, converter station, operation and controls of converters, characteristics, power control, starting and stopping of dclink.

Section-C

Flexible AC Transmission Systems: Fundamentals of ac power transmission, transmission problems and needs, Mechanism of active and reactive power flow control, basic FACTS controllers with application and principles of operation.

Section-D

Power Quality: Overview and definition of power quality, Sources of pollution, power quality disturbances, voltage fluctuations, unbalance waveform distortion, power frequency variations, mitigation and control of power quality issues.

Text / References

1. Rakesh Das Begmudre, Extra High Voltage AC Transmission Engineering, Wiley Estern Limited.
2. K.R. Padiyar, HVDC Power Transmission System, Wiley Estern Limited.
3. E.W. Kimbark. EHV-AC and HVDC Transmission Engineering & Practice, KhannaPublishers.
4. Math H. J. Bollen, Understanding Power Quality Problems: Voltage Sagsand Interruptions, Wiley-IEEE Press.
5. Flexible Ac Transmission Systems, Yong-Hua Song, Allan T. Johns, IEE publication
6. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, Narain G. Hingorani, Laszlo Gyugyi.

Course code	PEC-EE-417				
Category	Program Elective Course				
Course title	**Computer Aided Power System Analysis**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. To introduce computer applications in the analysis of power systems
2. To understand the solution methods and techniques used in power system studies

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. To understand the solution methods and techniques used in power systemstudies

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Network matrix: Primitive network, bus incidence matrix, formation of Y-bus by singular transformation , networks with mutually coupled elements ,formation of Z-bus by matrix inversion , formation of Z-bus using the building algorithm – addition of a tree branch p to reference bus , addition of a link between buses p and q , addition of a link between bus p and reference bus.

Section-B

Load flow analysis: Introduction , classification of buses , representation of transformers , Gauss Seidel iterative method using Y bus , N-R iterative method using Y-bus , approximation to the Jacobian in the NR method, Fast Decoupled L-F method, solution Using Z-bus in the bus frame of reference. Calculation of power.

Section-C

SYMMETRICAL AND UNSYMMETRICAL FAULT ANALYSIS: Single line to ground fault, Line to Line fault, Double line to Ground fault and symmetrical fault. Consideration of Pre fault currents. Symmetrical Components.

DIGITAL TECHNIQUES IN FAULT CALCULATIONS: Review of symmetrical components, Sequence networks for synchronous machines, transforms and transmission Lines. Bus Impedance matrix, Algorithm for formulation of Bus. All types of modifications, digital technique in short circuit Studies of: Single line to ground fault, Line to Line fault, Double line to Ground fault and symmetrical fault. Consideration of Pre fault currents.

Section-D.

COMPUTER CONTROL & AUTOMATION: Introduction to energy control centres, various states of a power system, SCADA Systems and RTU. Introduction to the MATLAB Power System block Set. Introduction of the features of EMTP.

Text / References

1. Power Systems Engineering by S. K. Gupta, Umeshpublication.
2. Power System Analysis & Design with CD by Glover, CengageLearning.
3. Power System Engg., by B.R.Gupta: S.Chand.
4. Power System Analysis: Hadi Saadat, TMH, New Delhi.
5. Computer Techniques in Power System analysis by M. APai.
6. Advance power system analysis and dynamics by L.P. Singh: Wiley Eastern ltd.

Course code	OEC-EE-401				
Category	Open Elective Course				
Course title	**Intelligent Systems and Control**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit.Thestudentshavetoattemptfivequestionsintotal,firstbeingcompulsory and selecting one from each unit.

Course Outcomes:

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

- Know about the basics approaches to intelligent controls.
- Know about basics and working of various types of fuzzy based controllers.
- Familiar to the basics and the practical implementations of the neural networks.
- Know about importance of the optimization techniques.
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SECTION-A

Introduction: Approaches to intelligent control; Architecture for intelligent control; Symbolic reasoning system; rule-based systems; AI approach; Knowledge representation; Expert systems.

SECTION-B

Fuzzy Logic Control System: Motivation and basic definitions; Fuzzy arithmetic and Fuzzy relations; Fuzzy logic modelling and control; Fuzzy knowledge and rule bases; Fuzzy modelling and control schemes for nonlinear systems; Self-organizing fuzzy logic control; Fuzzy logic control for nonlinear time-delay system; Stabilization using fuzzy models; Fuzzy estimators; Adaptive fuzzy control.

SECTION-C

ANN Based Controllers and Estimators: Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; simple Perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron; Learning and Training the neural network; Data Processing: Scaling; Fourier transformation; principal-component analysis and wavelet transformations; Hopfield network; Self-organizing network and Recurrent network; Neural Network based controllers and estimators.

SECTION-D

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps; Adjustment of free parameters; Solution of typical control problems using genetic algorithm; Concept on some other search techniques like tabu searchandant-colonysearchtechniquesforsolvingoptimizationproblems;EvolutionaryFuzzylogiccontrollers.

Text / Reference Books:

1. Padhy. N.P.: 'Artificial Intelligence and Intelligent System', Oxford University Press.
2. Kosko; B.: 'Neural Networks and Fuzzy Systems', Prentice-Hall of India Pvt.Ltd.
3. Jacek M. Zurada: 'Introduction to Artificial Neural Systems', Jaico Publishing House.
4. Klir G.J. & Folger T.A.: 'Fuzzy sets; uncertainty and Information', Prentice-Hall of India Pvt.Ltd.
5. Zimmerman H.J.: 'Fuzzy set theory-and its Applications', Kluwer Academic Publishers.
6. Driankov; Hellendroon: 'Introduction to Fuzzy Control', Narosa Publishers.
7. Goldberg D.E.: 'Genetic algorithms in Search; Optimization and Machine learning', Addison Wesley.
8. Stanislaw H. Zak: 'Systems and Control' Oxford University Press.

Course code	OEC-EE-403				
Category	Open Elective Course				
Course title	**Renewable Energy and Distributed Generation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand 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.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

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

Section-B

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

Section-C

Power Electronic Interface with the Grid, Impact of Distributed Generation on the Power System, Power Quality Disturbances

Section-D.

Transmission System Operation, Protection of Distributed Generators, Economics of Distributed Generation

Text / References

1. Ranjan Rakesh, 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", July2011,Wiley –IEEE Press
3. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators",October 2007, Wiley-IEEEPress.
4. RogerA.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 code	OEC-EE-405				
Category	Open Elective Course				
Course title	**Intelligent Systems and Control**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit.Thestudentshavetoattemptfivequestionsintotal,firstbeingcompulsory and selecting one from each unit.

Course Outcomes:

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

- Know about the basics approaches to intelligent controls.
- Know about basics and working of various types of fuzzy based controllers.
- Familiar to the basics and the practical implementations of the neural networks.
- Know about importance of the optimization techniques.

SECTION-A

Introduction: Approaches to intelligent control; Architecture for intelligent control; Symbolic reasoning system; rule-based systems; AI approach; Knowledge representation; Expert systems.

SECTION-B

Fuzzy Logic Control System: Motivation and basic definitions; Fuzzy arithmetic and Fuzzy relations; Fuzzy logic modelling and control; Fuzzy knowledge and rule bases; Fuzzy modelling and control schemes for nonlinear systems; Self-organizing fuzzy logic control; Fuzzy logic control for nonlinear time-delay system; Stabilization using fuzzy models; Fuzzy estimators; Adaptive fuzzy control.

SECTION-C

ANN Based Controllers and Estimators: Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; simple Perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron; Learning and Training the neural network; Data Processing: Scaling; Fourier transformation; principal-component analysis and wavelet transformations; Hopfield network; Self-organizing network and Recurrent network; Neural Network based controllers andestimators.

SECTION-D

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps; Adjustment of free parameters; Solution of typical control problems using genetic algorithm; Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems; Evolutionary Fuzzylogic controllers.

Text / Reference Books:

9. Padhy. N.P.: 'Artificial Intelligence and Intelligent System', Oxford UniversityPress.
10. Kosko; B.: 'Neural Networks and Fuzzy Systems', Prentice-Hall of India Pvt.Ltd.
11. Jacek M. Zurada: 'Introduction to Artificial Neural Systems', Jaico PublishingHouse.
12. Klir G.J. & Folger T.A.: 'Fuzzy sets; uncertainty and Information', Prentice-Hall of India Pvt.Ltd.
13. Zimmerman H.J.: 'Fuzzy set theory-and its Applications', Kluwer AcademicPublishers.
14. Driankov; Hellendroon: 'Introduction to Fuzzy Control', NarosaPublishers.
15. Goldberg D.E.: 'Genetic algorithms in Search; Optimization and Machine learning', AddisonWesley.
16. Stanislaw H. Zak: 'Systems and Control' Oxford UniversityPress.

Course code	**OEC-CE- 448**				
Category	Open Elective Courses (OEC)				
Course title	**Traffic Engineering and Road Safety**				
Scheme and Credits	L	T	P	**Credits**	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

1. Acquaint the students to basic concepts of Traffic and their significance.
2. To stimulate the students to think systematically and objectively about various traffic problems

COURSE OUTCOMES:

After completing this course, students should be able:

1. To realize the significance of traffic engineering in today life.
2. To understand the processes involved in traffic studies.
3. To appreciate the role of Traffic regulations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Module-1: Traffic Characteristics: Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India.
Module-2: Traffic Studies: Traffic volume study, speed study and origin and destination study. Speed and delay study.

Unit-II

Module-3: Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures. Capacity and Level of Service.
Module-4: Relationship between speed, volume and density, PCU, Design service volume, Capacity of non-urban roads. IRC recommendations, Brief review of capacity of urban roads.

Unit-III

Module-5: Traffic Control Devices: Signs, Signals, markings and islands. Types of signs, Types of signals, Design of Signal, Intersections at grade and grade separated intersections. Types of grades separated intersections, Parking surveys: On street parking, off street parking.

Unit-IV

Module-6 Road safety audit, RSA team, RSA Report, Elements of RSA,Vehicular air pollution and Situation in India, Motor vehicle act, Vehicular emission norms in India and abroad, Alternate fuels, Factors affecting fuel consumption.

RECOMMENDED BOOKS:

1. Principles of Transportation Engineering by Chakroborty& Das, Prentice Hall,India.
2. Highway Engg by S.K.Khanna& C.E.G. Justo, Nem Chand Bros.,Roorkee.
3. Traffic Engg and Transport Planning by L.R.Kadiyali, Khanna Publishers,Delhi.
4. Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd.N.Delhi.

Course code	OEC-ME-410				
Category	Open Elective Courses (OEC)				
Course title	**QUALITY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	
	3	0	0	3	
Objectives:	To understand the concept of Quality Engineering which emphasizes growth, creativity, and analytical thinking.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section A

Basic Concepts of Quality: Definitions of Quality and its importance in industry, Quality function, Quality Characteristics, Quality process, Quality Traits, Applications of Quality Concept, Introduction to quality control, Computer aided quality control, Total quality control(TQC) and its implementation, Elements of TQC, Quality Circle, Objectives of quality circle, Role of management in quality circle, Quality in service organizations, characteristics of a service organization, Important service dimensions, Design of servicequality.

Section B

Basic Statistical Concepts: The Concept of variation, Distinction between variables and attributes data, The frequency distribution, graphical representation of frequency distribution, Quantitative description of distribution, the normal curve, concept of probability, laws of probability, probability distributions, hyper geometric distribution, binomial distribution, The Poisson distribution.

Section C

Quality systems: Quality systems, Need for quality System, Need for standardization, History of ISO:9000 series standards and its features, steps to registration, India and ISO:9000, Automated inspection systems technologies, Different forms of Inspection, Industrial inspection,

Section D

Total Quality Management: Introduction o TQM, Concepts, Characteristics of TQM, Relevance of TQM, Approaches to TQM Implementation, TQM philosophies, Taguchi Philosphy, JIT, Kaizen, Six Sigma approach, 5-Sapproach

Course Outcomes:

Upon completion of this course the student will be able to:

CO1 - Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability

CO2 - Use control charts to analyze for improving the process quality.

CO3 - Describe different sampling plans

CO4 - Acquire basic knowledge of total quality management

CO5 - Understand the modern quality management techniques

Text Books:

1. Quality planning and Analysis, Juran and Gryna, TMH, NewDelhi
2. Quality Management, Kanishka Bed, Oxford University Press, NewDelhi
3. Introduction to SQC, Montgomery DC, 3e, Wiley, NewDelhi
4. Fundamentals of quality control and improvement, A Mitra, Mcmillan pub. Company,NY

Reference Books:

1. Fundamentals of Applied Statistics, Gupta and Kapoor, Sultan Chand and Sons, NewDelhi.

Course code	OEC-EE-407				
Category	Open Elective Courses (OEC)				
Course title	**SOLAR PHOTOVOLTAIC TECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

On end of the syllabus or completion of the course, students will be able

1 Understand the electrical properties and Behaviour of Solar Cells.
2 To design of various PV-interconnected systems.
3 To understand about the comparison of various source applications.

Course Outcomes:

Upon successful completion of the course, students will be able

1. To explain basics of solar photovoltaic systems.
2. To know in depth of its types and design of various PV-interconnected systems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

PHOTOVOLTAIC BASICS: Structure and working of Solar Cells - Types, Electrical properties and Behaviour of Solar Cells - Cell properties and design - PV Cell Interconnection and Module Fabrication - PV Modules and arrays - Basics of Load Estimation.

Section-B

STAND ALONE PV SYSTEMS: Schematics, Components, Batteries, Charge Conditioners - Balance of system components for DC and/or AC Applications - Typical applications for lighting, water pumping etc.

Section-C

GRID CONNECTED PV SYSTEMS: Schematics, Components , Charge Conditioners, Interface Components - Balance of system Components - PV System in Buildings.

Section-D

HYBRID SYSTEMS: Solar, Biomass, Wind, Diesel Hybrid systems - Comparison and selection criteria for a given application.

REFERENCES

1. CS Solanki: Solar Photovotaics – Fundamentals, Technologies and Applications, PHI Learning Pvt. Ltd., 2011.
2. MartinA.Green,SolarCellsOperatingPrinciples,Technology,andSystemApplicationsPrentice-Hall,2008.
3. Nelson, J The Physics of Solar Cells. Imperial College Press, 2003. Thomas Markvart, Solar Electricit, John Wiley and Sons,2001.
4. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish (Editors), Applied Photovoltaics, Earthscan, 2008.
5. Michael Boxwell, The Solar Electricity Handbook, Code Green Publishing, UK,2009.
6. RikDeGunther, Solar Power Your Home for Dummies, Wiley Publishing Inc,2008.
7. Photovoltaics: Design and Installation Manual, Published by Solar Energy International.

Course code	**OEC-EE-409**				
Category	Open Elective Courses (OEC)				
Course title	**Energy Conservation and Management**				
Scheme and Credits	L	T	P	**Credits**	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

1. Understand and analyse the energy data of industries
2. Carryout energy accounting and balancing
3. Conduct energy audit and suggest methodologies for energy savings and utilise the available resources in optimal ways
4. To present a problem oriented in depth knowledge of Energy conservation management
5. To address the underlying concepts and methods behind Energy conservation management

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the basic knowledge of different terms & principles of energy conservation, audit and management.
2. Evaluate the energy saving & conservation in different mechanical utilities.
3. Understand efficient heat & electricity utilization, saving and recovery in different thermal and electrical system.
4. Prepare energy audit report for different energy conservation instances.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Energy Conservation: Introduction, Motivation for Energy Conservation, Principles of Energy Conservation, Energy Conservation Planning, Energy Conservation in Industries, Electrical Energy Conservation in Small Scale Industries, Energy Conservation in Electrical Generation, Transmission and Distribution, Energy Conservation in Household and Commercial Sectors, Energy Conservation in Transport, Energy Conservation in Agriculture, Energy Conservation Legislation.

Section-B

Cogeneration: Definition and Scope, Topping and Bottoming Cycles, Benefits, Industries Suitable for Cogeneration, Industrial Suitable for Cogeneration, Agricultural Uses of Waste Heat, Aqua cultural Uses of Waste Heat, Use of Power Plant Reject Heat for Waste Water Treatment, Integrated Energy System, Potential of Cogeneration in India.

Section-C

Demand Side Management: Introduction, Scope of Demand Side Management, Evolution of DSM Concept, DSM Planning and Implementation, Load Management as a DSM Strategy, Applications of Load Control, End use Energy Conservation, Tariff Options for DSM, Customer Acceptance, Implementation Issues, Implementation Strategies, DSM and Environment, International Experience with DSM..

Section-D.

Environmental Aspects of Electric Energy Generation: Environment and its Quality, Man's Right to Modify Environment, Energy and Environment, Air Pollution, Stack Emissions, Cooling Tower Impacts, Aquatic Impacts, Nuclear Plant Impacts, Hydro-Plant Impacts, Social and Economic Impacts.

Text / References

1. GuptaB.R.: Generation of ElectricalEnergy,EurasiaPublishingHousePvt.Ltd.,NewDelhi,2001IVEdition.
2. Durgesh Chandra &: Energy Scope, South Asian Publishers Pvt. Ltd, New Delhi.
3. M.V. Deshpande: Electrical Power System, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. J. Nandaand D.P.Kothari: Recent Trendsin ElectricEnergySystems,PrenticeHallofIndiaPvt.Ltd, New Delhi.

Course code	**OEC-CE- 450**				
Category	Open Elective Course				
Course title	**Disaster Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

1. To provide basic conceptual understanding of disasters and its relationships with development.
2. Provide an understanding of the social nature of natural hazards and disasters
3. Increase awareness of hazards and disasters around the world and the unequal social consequences stemming from disaster events.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Terminology,Global and Indian scenario, role of engineer, importance of study in human life, long term effects of disaster. Geological Mass Movement and land disasters, Atmospheric disasters, DisasterMitigation

Unit-II

Natural Disaster: Nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozonedepletion

Man-made Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit -III

Case Studies: Damage profile analysis- Uttarkashi/Bhuj/Latur earthquakes, Kerala floods, cyclone Fani and Amphan, Bihar floods, Covid 19.

Unit IV

Disaster Management: Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India.Applications of GIS, Remote sensing and GPS in thisregard.

COURSE OUTCOMES:

After completing this course, students should be able:

1. To know natural as well as manmade disaster and their extent and possible effects on the economy.

2. To Plan national importance structures based upon the previoushistory.
3. To acquaint with government policies, acts and various organizational structures associated with an emergency.
4. To know the simple dos and don’ts in such extreme events and actaccordingly.

REFERENCE BOOKS:

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010.
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012.
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

Course code	**OEC-ECE-451**				
Category	**Open Elective Course**				
Course title	**Electronic Principles**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. Study the basic principles of electronic systems.
2. Understand working of Digital electronics.
3. Understand the working of Display devices.

UNIT 1 SEMICONDUCTOR DIODE: P-N junction and its V-I Characteristics, P-N junction as a rectifier, Switching characteristics of Diode. Diode as a circuit element, the load-line concept, half -wave and full wave rectifiers, clipping circuits, clamping circuits, filter circuits, peak to peak detector and voltage multipliercircuits.

UNIT 2 ELECTRONIC DEVICES: LED, Zener Diode as voltage regulator, BJT, UJT, MOSFET, Thyristor, DIAC, TRIAC.

UNIT 3 DISPLAY DEVICES: LED, LCD, Seven Segment, Sixteen Segment.

UNIT 4 DIGITAL ELECTRONICS: Binary, Octal and Hexadecimal number system and conversions, Boolean Algebra, Truth tables of logic gates (AND, OR, NOT) NAND, NOR as universal gates, Difference between combinational circuits and sequential circuits, Introduction to flipflops (S-R & J-K).

TEXT BOOK : 1.Integrated Electronics: Millman & Halkias ; McGrawHill
2.Modren Digital Electronics: R.P. Jain; McGraw-Hill

REFERENCE BOOKS:

1. Electronics Principles: Malvino ; McGrawHill
2. Electronics Circuits: Donald L. Schilling & Charles Belove ; McGrawHill
3. Electronics Devices & Circuits: Boylestad & Nashelsky ; Pearson.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Understand the working of electronic components.
2. Understand the Digital System and various displays.

Course code	OEC-MATH-405				
Category	**Open Elective Course**				
Course title	**Advanced Engineering Mathematics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. To understand the basic knowledge of linear and Nonlinear programmingproblems.
2. To understand the various useful probability distribution and theory of statistics in sampletesting.
3. To understand the various method to solve the Linear programming Problems (LPP) and Nonlinear LPP.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Estimate the actual complexity of the Linear programming Problems (LPP) and Nonlinear LPP.
2. Explain the main principles for constructing the optimal methods for solving different types of minimization problems.
3. Experience in solving difficult Linear programming Problems (LPP) and Nonlinear LPP.
4. Experience to apply the various useful statistical test of the hypothesis testing of real-world problems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Optimization Fundamentals: Definition; classification of optimization problems; Unconstrained and constrained optimization; optimality conditions. Lagrange Multipliers, formulation of multivariable optimization, Kuhn-Tucker conditions.

Linear Programming: Simplex Method; Duality; Sensitivity Analysis; Dual Simplex method. Assignment Problem.

Section-B

Nonlinear Programming: Powel's method; steepest descent method; conjugates gradient method; Newton's Method GRG method; Sequential quadratic programming; Penalty function method; Augmented Lagrange multiplier method.

Section-C

Dynamic Programming and Integer Programming: Interior point methods; Karmakar's algorithm; Dual affine; Primal affine; Barrie algorithm.

Section-D

Statistics and Probability: Probability theory, Baye's theorem, Binomial, Poisson and normal distributions, testing of hypothesis, Chi square test- goodness of fit, Student's t-test, F-test.

Text / References

1. Operation Research: An Introduction by H. A. Taha, Pearson Prentice HallPublication.
2. Non linear Programming: Theory & Algorithms by M.S Bazara, H. D. Shorali and C.M Shetty, Johan Wiley & Sons.
3. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley &Sons.
4. B.S. Grewal, Higher Engineering Mathematics, KhannaPublishers.

Course code	OEC-CSE-430				
Category	**Open Elective Course**				
Course title	**Computer Communication**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Learning Objectives:

1. To Build an understanding of the fundamental concepts of computer networking and familiarizing the student with the basic taxonomy and terminology of the computer networking and data communication.
2. To outline various models, topologies and devices of Computer Networks.
3. To explain the functions of various layers in Network Reference Model.
4. To apply different network concepts in various network communication protocols.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit 1

Introduction to Data Communication: Need, components, Data representations communication model, Characteristics of an effective Communication system, Transmission modes: Simplex, Half Duplex and Full Duplex. Serial and parallel transmission. Unicasting, Multicasting, Broadcasting, Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM), Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, **MULTIPLEXING**: FDM, WDM, TDM, packet switching and circuit switching.**Transmission Media**: Copper cable, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable. Introduction to Computer Network: applications, benefits and problems, Types of Networks: PAN, LAN, MAN andWAN.

Unit 2

Network Topologies: Introduction to Computer Network Topologies: Mesh Topology, Bus Topology, Star Topology, Ring Topology, Tree Topology, Hybrid Topology, Irregular – Topology.
OSI and TCP/IP Model: Layering architecture of networks, OSI model, Functions of each layer, Services and Protocols of each layer

Unit 3

Media Access Control, Random Access: ALOHA, CSMA and CSMA/CD. Controlled Access: Reservation, Polling and Token Passing. Channelization: FDMA, TDMA and CDMA
Ethernet: Features and types of LANs, Types of Ethernets- Thicknet, Thinnet, Fast Ethernet and Gigabit and 10G Ethernet etc. Concept of Carrier Sense Multiple Access (CSMA)/CD in Ethernet,
Network addressing: Physical addressing, logical addressing and port addressing, MAC addressing in Ethernet, IP V4 addressing: concept of subnet, network and host address, IP address Classes- A, B, C, D and E classes. Introduction to classlessaddressing.

Unit 4

LAN interconnecting devices: Repeater, Hubs, Switches, Bridges, Routers, Gateways.
Internet and E-mail: Concept of Internet, Advantages of Internet, Security issues in using internet. Application of Internet in various fields: Scientific, Business, Research, Sports, Medicine & Health Care, Engineering, Teaching. HTTP and FTP

Email :concept, Protocols: SMTP, POP, IMAP.

Text Book:

1. Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson publications,2010.
2. Forouzan, Data Communication and networking ,5th Edition, Tata McGrawHill,2012.
3. William Stalling, Data & Computer Communication 6th edition, LPE Pearson Education,2013.
4. Reference Books:
5. Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred, 2000, Addison Wesley, Low Price Edition.
6. Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2 Edition
7. Computer Networking – ED Tittel , 2002, T.M.H.

Learning Outcomes:

By the end of the course the students will be able to:

1. Independently understand basic computer network technology.
2. Understand and explain Data Communications System and its components.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5. Identify the different types of network devices and their functions within a network

Course code	**HSMC-08**				
Category	**Open Elective Course**				
Course title	**FUNDAMENTALS OF MANAGEMENT**				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Objectives:	Students will be able to understand: 1. Evolution of Management and contribution of Management thinkers. 2. The importance of staffing and training 3. The concept of material management and inventory control 4. The components of marketing and advertising				
	5. Various sources of finance and capital structure.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Meaning of management, Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management.

Development of Management thoughts. Principles of Management. The Management Functions, Inter-relationship of Managerial functions. Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

UNIT-II

Production Management: Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and variousmethods.

UNIT-III

Marketing Management - Definition of marketing, marketing concept, objectives & Functions of marketing. Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

UNIT-IV

Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

Course outcomes:

Students will be able to understand

CO1 - Evolution of Management and contribution of Management thinkers.

CO2 - importance of staffing and training

CO3 - the concept of material management and inventory control

CO4 - the components of marketing and advertising

CO5 - various sources of finance and capital structure

TEXT BOOKS:

1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S.Bhalla.(KalyaniPublishers)
2. Organisation and Management - R.D. Aggarwal (Tata Mc GrawHill)

REFERENCES:

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand &Sons)
2. Management – Harold, Koontz and CyriloDonell (Mc.GrawHill).

3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House,Bombay).
4. Financial Management - I.M. Pandey (Vikas Publishing House, NewDelhi)
5. Management - James A.F. Stoner &R.Edward Freeman,PHI.

Course code	PEC-EE-402				
Category	Program Elective Course				
Course title	**Special Electrical Machines**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Impart knowledge on construction, principle of operation and performance of all ac and dc machines with small and higher rating.
2. Understand the concepts of rotating magnetic fields.
3. Analyze performance characteristics of ac machines.
4. Preparethestudentstohaveabasicknowledgeaboutmotoring,generatingandbrakingmodeofacmachines

UNIT-I

POLY-PHASE AC MACHINES: Construction and performance of double cage and deep bar three phase induction motors, production of rotating magnetic field, induction motor action,e.m.f. induced in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power), stator voltage control, stator resistance control, frequency control, rotor resistance control, slip power recovery control, induction motor as an inductiongenerator.

UNIT-II

SINGLE-PHASE INDUCTION MOTORS: Construction, equivalent circuit, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitor start capacitor-run and shaded pole motors.

SINGLE-PHASE COMMUTATOR MOTORS :Construction, principle of operation, characteristics of universal and repulsion motors ; Linear Induction Motors. Construction, principle of operation, applications.

TWO PHASE AC SERVO MOTORS:

Construction, torque-speed characteristics, performance and applications.

UNIT-III

STEPPER MOTORS: Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications.

SWITCHED RELUCTANCE MOTORS: Construction; principle of operation; torque production, modes of operation, drive circuits.

UNIT-IV

PERMANENT MAGNET MACHINES: Permanent magnet dc motors, sinusoidal PM ac motors, brushless dc motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors;

TEXT/ REFERENCE BOOKS:

1. Principle of Electrical Machines, V K Mehta, Rohit Mehta, SChand
2. Electric Machines ,Ashfaq Hussain, DhanpatRai
3. Electric Machines: I.J.Nagrath and D.P. Kothari, TMH, NewDelhi.
4. Generalized theory of Electrical Machines: P.S. Bhimbra(Khanna Pub.)
5. Electric Machinery, Fitzgerald and Kingsley,MGH.
6. P.C. Sen " Principles of Electrical Machines and Power Electronics" John willey & Sons, 2001
7. G.K.Dubey "Fundamentals of Electric Drives" Narosa Publishing House,2001.

Course code	PEC-EE-404				
Category	Program Elective Course				
Course title	**Applications of Power Electronics in Power Systems**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit.Thestudentshavetoattemptfivequestionsintotal,firstbeingcompulsoryandselectingonefromeachunit.

Course Objectives:

1. Theoretical and practical knowledge on modern day semiconductor devices, their characteristics and control.
2. Knowledge of power conditioners and their application.
3. Working knowledge of static applications of advanced power electronics like UPS, HVDC,etc.
4. Learning Modeling and Analysis of FACTS controllers.

Course Outcomes:

1. Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-lineardevices.
2. Describe basic operation and compare performance of various power semiconductor devices, passive components and switchingcircuits
3. Design and Analyze power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.
4. Formulate and analyze a power electronic design at the system level and assess the performance. 5. Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.
5. Recognize the role power electronics play in the improvement of energy usage efficiency and the applications of power electronics in emerging areas.

SECTION-A

Steady state and dynamic problems in AC systems: Flexible AC transmission systems (FACTS), Principles of series and shunt compensation, Description of static var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC).

SECTION-B

Modeling and Analysis of FACTS controllers: Control strategies to improve system stability, Power Quality problems in distribution systems

SECTION-C

Harmonics: Harmonics creating loads, modeling, harmonic propagation, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters.

SECTION-D

Voltage sags & swells, voltage flicker, Mitigation of power quality problems using power electronic conditioners, IEEE standards, HVDC Converters and their characteristics, Control of the converters (CC and CEA), Parallel and series operation of converters.

Text / Reference Books:

1. N.G. Hingorani& Laszlo Gyugyi , Understanding FACTS , IEEE Press,2000.
2. E. F. Fuchs & Mohammad A.S. Masoum, Power Quality in Power Systems and Electrical Machines, Elsevier Academic Press2008.
3. K.R. Padiyar, FACTS controllers in power transmission and distribution, New Age International publishers, New Delhi, 2007.
4. K.R.Padiyar, HVDC Power Transmission Systems,New Age International publishers,NewDelhi,1999.

Course code	PEC- EE-406				
Category	Program Elective Course				
Course title	**Power System Stability**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. Understand the general information about power system stability problems.
2. Understand the classification and prevention of different type of stability.
3. Understand the principle of synchronous machines and its modeling.
4. Understand the state space model and state space representation of simplified model of synchronous machine.
5. Understand the causes and prevention of dynamic stability.
6. Understand the causes and prevention of transient stability.
7. Understand the causes and prevention of voltage stability.
8. Understand the general information about voltage collapse and how to overcome voltage collapse.

. Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. understand about the classification of stability.
2. know power system stability problem.
3. know about synchronous machine modelling.
4. how to handle various stability and unstability problem.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsoryand selecting one from each Unit.

Section-A

Power System Stabikity Problem : Rotor angle stability, voltage stability, short term and long term stabilities, swing equation and its solution techniques

Section-B

Synchronous Machine and Its Modelling : Power transformation, flux linkage equations, voltage equation, formulation using state-space equations, normalizing voltage and torque eqns., equivalent circuit of synchronous m/c, the flux linkage state-space model. Linearization of the flux linkage model, Simplified linear model block diagram, state-space representation of simplified model

Section-C

Dynamic Stability : State-space representation, stability of a dynamic system, analysis of stability, Eigen properties of the state matrix, Small signal stability of a single m/c infinite bus system, Effect of excitation systems, power system stabilizer, system state matrix with armature winding

Transient Stability : An elementary view of transient stability, numerical integration methods, simulation of power system dynamic response

Section-D.

VOLTAGE Stability : Basic concept related o voltage stability, voltage collapse, voltage stability analysis, prevention of voltage collapse.

Sub-Synchronous Oscillators : Turbine generator torsional characteristics, characteristics of series capacitor compensated transmission system, Self excitation, torsional interaction, counter measure to SSR problems, ferro resonance.

Text / References

1. Power System Stability and Control by Prabha Kumar:MGH
2. Power System Control and Stability by Anderson and Fouad: Galgotia Publications
3. Extra high voltage AC Transmission Engg. By Rokosh Das Begamudre
4. Electrical energy theory: An Introduction by O.I. Elgerd:TMH

Course code	PEC- EE-408				
Category	Program Elective Course				
Course title	**Advanced Control Systems**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit.Thestudentshavetoattemptfivequestionsintotal,firstbeingcompulsory andselectingonefromeachunit.

Course Objectives:

1. To provide a strong concept on the compensator design and on advanced control system analysis and design techniques
2. To analyze the behavior of discrete time systems and nonlinear control systems.

Course Outcomes:

1. Design compensators using classical techniques.
2. Analyze both linear and nonlinear system using state space methods.
3. Analyze the stability of discrete system and nonlinear system.

SECTION-A

Types of controller- Feedforward-feedback-cascade-P, PI and PID. Compensator design: Realization of compensators – lag, lead and lag-lead -Design of compensator using bode plot.

Compensator design: Realization of compensators – lag, lead and lag-lead.

SECTION-B

State space analysis of systems: Introduction to state concept - state equation of linear continuous time systems, matrix representation of state equations. Phase variable and canonical forms of state representation-controllable, observable, diagonal and Jordan canonical forms- solution of time invariant autonomous systems.

SECTION-C

State feedback controller design: Controllability & observability. State feed-back design via pole placement technique. Sampled data control system: Pulse Transfer function-Stability of sampled data system -Routh Hurwitz criterion. Introduction to state-space representation of sampled data systems

SECTION-D

Nonlinear systems: Introduction - characteristics of nonlinear systems. Types of nonlinearities. Analysis through harmonic linearisation - Determination of describing function of nonlinearities (relay, dead zone and saturation only)-applicationofdescribingfunctionforstabilityanalysisofautonomoussystemwithsinglenonlinearity.

Text / Reference Books:

1. Hassan K Khalil, Nonlinear Systems, Prentice - Hall International (UK),2002.
2. Kuo B.C, Analysis and Synthesis of Sampled Data Systems, Prentice HallPublications.
3. Nagarath I. J. and Gopal M., Control System Engineering, Wiley Eastern,2008.
4. Nise N. S., Control Systems Engineering, 6/e, Wiley Eastern,2010.
5. Ogata K., Modern Control Engineering, Prentice Hall of India, New Delhi,2010
6. Alberto Isidori, Nonlinear Control Systems, Springer Verlag,1995.
7. GibsonJ.E.,F.B.TuteurandJ.R.Ragazzini,ControlSystemComponents,TataMcGrawHill,2013
8. Gopal M., Control Systems Principles and Design, Tata McGraw Hill,2008.
9. Jean-Jacques E. Slotine&Weiping Li, Applied Nonlinear Control, Prentice-Hall., NJ, 1991.C

Course code	PEC- EE-410				
Category	Program Elective Course				
Course title	**Advances in Power Transmission & Distribution**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Objectives:

1. Understand Knowledge of Extra High Voltage AC & DC Transmission System
2. To understand and estimation of transmission line parameters.
3. To obtain the equivalent circuits of the transmission lines for determining voltage regulation and efficiency.
4. To know about the FACTS controllers.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Discuss Modelling of the transmission line parameters.
2. Explain the equivalent circuits for the transmission lines based on distance and determine voltage regulation and efficiency.
3. To deal with the importance of HVDC Transmission and HVDC Converters
4. Knowledge of Modern power controllers to enhance the stability and capability of existing network. 5 Monitoring and improvement of Power Quality

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 6 parts of 2.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsoryand selecting one from each Unit.

Section A

Basic theory of line compensation. FACTS devices, The FACTS optimisation problem. Transient and dynamic stability enhancement using FACTS components.

Section B

Introduction to Electrical Distribution System, Components of Distribution System Substation and Busbar Layouts, Introduction to distribution automation, Layout of substations and feeders, Optimum siting and sizing of substations.

Section C

Distribution system load flow, configuration of distribution system, optimum capacitor placement. Optimum feeder switching for loss minimization and load control. Distribution system restoration.

Section D

Distribution system monitoring and control: SCADA, Concept of modern distribution systems. Concepts of modern grid.

Text / References

1. Flexible Ac Transmission Systems, Yong-Hua Song, Allan T. Johns, IEE publication
2. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, Narain G. Hingorani, LaszloGyugyi.
3. https://nptel.ac.in/courses/108/107/108107112/
4. "Electric Power Distribution system, Engineering" – by Turan Gonen, McGraw–hill Book Company.
5. Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo, CRC press
6. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing company, 4th edition,1997.
7. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.

Course code	**PROJ-EE-426**				
Category	**Professional Core Courses**				
Course title	**SEMINAR**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	0	**0**	1	**1**	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

OBJECTIVE:

To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.