10EE81 ELECTRICAL DESIGN, ESTIMATING AND COSTING

Subject Code	:	10EE81	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT: 1

GENERAL PRINCIPLES OF ESTIMATION: Introduction to estimation & costing, Electrical Schedule, Catalogues, Market Survey and source selection, Recording of estimates, Determination of required quantity of material, Labor conditions, Determination of cost material and labour, Contingencies, Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Tender form, General idea about IE rule, Indian Electricity Act and major applicable I.E rules. **6Hours**

UNIT: 2

RESIDENTIAL BUILDING ELECTRIFICATION: General rules guidelines for wiring of residential installation and positioning of equipments, Principles of circuit design in lighting and power circuits, Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram, Selection of type of wiring and rating of wires and cables, Load calculations and selection of size of conductor, Selection of rating of main switch, distribution board, protective switchgear ELCB and MCB and wiring accessories, Earthing of residential Installation, Sequence to be followed for preparing estimate, Preparation of detailed estimates and costing of residential installation. **7Hours**

UNIT:3

ELECTRIFICATION OF COMMERCIAL INSTALLATION: Concept of commercial installation, Differentiate between electrification of residential and commercial installation, Fundamental considerations for planning of an electrical installation system for commercial building, Design considerations of electrical installation system for commercial building, Load calculation and selection of size of service connection and nature of supply, Deciding the size of the cables,busbar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch etc, Earthing of the electrical installation, Selection of type wire, wiring system and layout, Sequence to be followed to prepare estimate, Preparation of detailed estimate and costing of commercial installation. **7Hours**

UNIT: 4

SERVICE CONNECTION, INSPECTION AND TESTING OF INSTALLATION: Concept of service connection, Types of service connection and their features, Method of installation of service connection, Estimates of under ground and overhead service connections, Inspection of internal wiring installations, Inspection of new installations, Testing of installations, Testing of wiring installations, Reason for excess recording of energy consumption by energy meter. **6Hours**

PART- B

UNIT: 5

ELECTRICAL INSTALLATION FOR POWER CIRCUITS: Introduction, Important considerations regarding motor installation wiring, Determination of input power, Determination of input current to motors, Determination of rating of cables, determination of rating of fuse, Determination of size of Condit, distribution Board main switch and starter**. 6Hours**

UNIT:6 and 7

DESIGN AND ESTIMATION OF OVERHEAD TRANSMISSION & DISTRIBUTION LINES: Introduction, Typical AC electrical power system, Main components of overhead lines, Line supports, Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials, Types of insulators, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers, Muffs, Points to be considered at the time of erection of overhead lines, Erection of supports, Setting of stays, Fixing of cross arms, Fixing of insulators, Conductor erection, Repairing and jointing of conductor , Dead end clamps, Positioning of conductors and attachment to insulators, Jumpers, Tee-offs, Earthing of transmission lines, Guarding of overhead lines, Clearances of conductor from ground, Spacing between conductors, Testing and commissioning of overhead distribution lines, Some important specifications. **12Hours**

UNIT: 8

DESIGN AND ESTIMATION OF SUBSTATIONS: Introduction, Classification of substation, Indoor substations, Outdoor substations, Selection and location of site for substation, Main Electrical Connections, Graphical symbols for various types of apparatus and circuit elements on substation main connection diagram, Key diagram of typical substations, Equipment for substation and switchgear installations, Substation auxiliaries supply, Substation Earthing **6Hours**

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TEXT BOOK:

1. **Electrical Installation Estimating & Costing,**J.B.Gupta,VIII Edition S.K. Katria & Sons New Delhi

REFERENCE BOOKS :

1. **Electrical Design Estimating and Costing,** K.B.Raina S.K.Bhattacharya, New Age International
2. **Electrical Wiring Estimating and Costing,** Uppal, Khanna Publishers Delhi
3. **I.E.Rules and Act Manuals**

10EE82 POWER SYSTEM OPERATION AND CONTROL

Subject Code	:	**10EE82**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

CONTROL CENTER OPERATION OF POWER SYSTEMS:

Power system control and operating states, control center, digital computer configuration, automatic generation control, area control error, operation without central computers, expression for tie-line flow and frequency deviation, parallel operation of generators, area lumped dynamic model. **8 Hours**

UNIT - 2 & 3

AUTOMATIC VOLTAGE REGULATOR: Basic generator control loops, Cross-coupling between control loops, Exciter types, Exciter modeling, Generator modeling, Static performance of AVR loop.

AUTOMATIC LOAD FREQUENCY CONTROL:

Automatic Load frequency control of single area systems, Speed governing system, Hydraulic valve actuator, Turbine generator response, Static performance of speed governor, Closing of ALFC loop, Concept of control area, Static response of primary ALFC loop, Integral control, ALFC of multi-control area systems (POOL operation),The Two-Area system, Modeling the Tie-Line, Block Diagram representation of Two-Area system, Static response of Two-Area system and Tie-Line Bias control.

12 Hours

UNIT - 4

CONTROL OF VOLTAGE AND REACTIVE POWER: Introduction, generation and absorption of reactive power, relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse.

6 Hours

PART - B

UNIT - 5

OPTIMAL SYSTEM OPERATION AND UNIT COMMITMENT: Introduction , Optimal operation of generators on a bus bar, Statement of the Unit Commitment problem, need and importance of unit commitment, Constraint in Unit Commitment, Unit Commitment solution methods-Priority lists method, Forward Dynamic Programming method(excluding problem), Spinning reserve. **6 Hours**

UNIT - 6

POWER SYSTEM SECURITY: Introduction, factors affecting power system security, Security analysis, Contingency Selection, Techniques for contingency evaluation-D.C. load flow and fast decoupled load flow. **6 Hours**

UNIT 7

SYSTEM MONITORING AND CONTROL: Introduction , Energy management system, the basis of power system state estimation(PSSE), mathematical description of PSSE process, minimization technique for PSSE, Least Square estimation, Error and detection in PSSE, System security and emergency control.

6 Hours

UNIT- 8

POWER SYSTEM RELIABILITY: Introduction, Modes of failures of a system, Generating system and its performance, derivation of reliability index, reliability measure for N- unit system, cumulative probability outages- Recursive Relation, Loss of load probability, Frequency and duration of a state.

8 Hours

Text Books:

1. **Modern Power System Analysis-** I J Nagarath and D P Kothari, TMH, 3rd Edition, 2003
2. **Electrical Energy Systems Theory**, O.J Elgerd, TMH,2008.
3. **Power generation, operation and control**- Allen J Wood & Woollenberg. John Wiley and Sons, Second Edition, 2009.
4. **Electric Power Systems-** B.M.Weedy and B.J. Cory, Wiley student edition, 1999
5. **Computer Aided Power System Operation and Analysis-** R.N. Dhar, Tata McGraw-Hill, 1987.

REFERENCE:

1. **Computer Aided Power System Analysis-** G.L.Kusic, PHI,2010.
2. **Power System Analysis, Operation and Control,** Abhijit Chakrabarti and Sunita Halder, PHI, Second Edition, 2009
3. **Power system stability and control,** Prabha Kundur, TMH, 9th reprint, 2007.

ELECTIVE – IV (GROUP - D)

10EE831 REACTIVE POWER MANAGEMENT

Subject Code	:	**10EE831**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT – 1

Introduction, Importance of reactive power control in EPS, Reactive power devices. **4 Hours**

UNIT – 2

Theory of Load Compensation: Introduction- Requirement for compensation, Objectives in load compensation, Specifications of a load compensator, Power factor correction and voltage regulations in single phase system, Phase balancing and p. f. correction of unsymmetrical loads, Compensation in term of symmetrical components. **8 Hours**

UNIT – 3

Reactive Power Control: Fundamental requirement in AC Power transmission, Fundamental transmission line equation, Surge impedance and natural loading, Voltage and current profiles of uncompensated radial and symmetrical line on open circuit, Uncompensated line under load, Effect of line length, Load power and p. f on voltage and reactive power. **8 Hours**

UNIT – 4

Passive and active compensators, Uniformly distributed fixed compensation, Passive shunt compensation, Control of open circuit voltage by shunt reactance, Reactance of shunt reactors, multiple shunt reactors along the line. **6 Hours**

PART – B

UNIT - 5

Series compensation: Objectives and practical limitations, Symmetrical line with mid-point series capacitor and shunt reactor, Power transfer characteristics and maximum transmissible power for a general case, Fundamental concepts of compensation by sectioning. **6 Hours**

UNIT - 6

Principles of Static Compensation: Principle of operation of thyristor controlled reactor, Thyristors switched capacitor. Series Capacitors: Introduction, protective gear, reinsertion schemes, Varistor protective gear. **6 Hours**

UNIT – 7

Synchronous Condenser: Introduction, Power system Voltage control, Emergency reactive power supply, Starting methods, starting motor, reduced voltage starting, static starting. **6 Hours**

UNIT – 8

Harmonics effects, resonance, shunt capacitors and filters, telephone interferences, Reactive Power Co-ordination, Reactive power management, transmission benefits, reactive power dispatch & equipment impact. **8Hours**

TEXT BOOKS:

1. **Reactive power control in electric power systems**, T. J. E. Miller, John Wiley & Sons NY 2009
2. **Reactive Power Management**, D. Tagare, TMH, 1st Edition,2004.

REFERENCE BOOKS:

1. **Power System Stability and Control**,P. Kundur, TMH, 9th reprint, 2007.
2. **Power System Voltage Stability**, Carson. W. Taylor, McGraw-Hill, Inc.

10EE832 FLEXIBLE A.C. TRANSMISSION SYSTEMS (FACTS)

Subject Code	:	**10EE832**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT-1 & 2

Facts, Concepts and general system configuration: Transmission, interconnection, flow of power in AC system, power flow and dynamic stability consideration of a transmission interconnection, relative importance of controllable parameters, basic types of FACTs controllers, shunt, series, combined shunt and series connected controllers. **10 Hours**

UNIT -3

POWER SEMICONDUCTOR DEVICES: types of high power devices, principle of high power device characteristics and requirements, power device material, diode, MOSFET, MOS turn OFF thyristor, emitter turn OFF thyristor, integrated gate commuted thyristor (GCT & IGCT). **10 Hours**

UNIT -4

VOLTAGE SOURCED CONVERTERS: Basic concepts, single-phase full wave bridge converter operation, square wave voltage harmonics for a single-phase bridge 3-phase full wave converter. **6 Hours**

PART – B

UNIT -5

SELF AND LINE COMMUTATED CURRENT SOURCE CONVERTER: Basic concepts, 3 phase full wave rectifier, thyristor based converter, current sourced converter with turnoff devices, current sourced versus voltage source converter. **6 Hours**

UNIT -6

STATIC SHUNT COMPENSATORS SVC AND STATCOM: Objective of shunt compensation, methods of controllable Var generation, static Var compensator, SVC and STA TCOM, comparison between, SVC and STA TCOM. **10 Hours**

UNIT -7& 8

STATIC SERIES COMPENSATORS: GCSC, TSSC, TCSC and SSSC, objectives of series compensation, variables impedance type of series compensation, switching converter type series compensation, external control for series reactive compensators. **10 Hours**

TEXT BOOKS:

1. **Understanding Facts - Concepts and technology of flexible AC Transmission system,** N.G.Hungorian & Laszlo gyugyi IEEE Press, standard publisher, 2001.

REFERENCE BOOKS:

1. **EHV - AC, HYDC Transmission & Distribution Engineering,** S.Rao,Khanna publishers, 3rd edition 2003.
2. **FACTS - Controllers in Power Transmission distribution** - K.R. Padiyar - New age publishers - 2007.

10EE833 ADVANCED INSTRUMENTATION SYSTEM

Subject Code	:	**10EE833**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

Part - A

UNIT - 1

Instrumentation: Frequency meter, measurement of time and frequency (mains), tachometer, phase meter, capacitance meter. Automation in digital Instrumentation. **6 Hours**

UNIT – 2

Analyzer: Wave analyzers and Harmonic distortion, Basic wave analyzer, Frequency selective wave analyzer, Harmonic distortion analyzer and Spectrum analyzer**.** **8 Hours**

UNIT – 3

Measuring Instruments: Output power meters, Field strength meter Vector impedance meter, Q meter applications-Z, Z_0 and Q. Basic LCR bridge, RX meters**.** **6 Hours**

UNIT – 4

Recorders: Strip chart recorder- applications of Strip chart recorder, Magnetic recorders, Frequency modulation (FM) recording, Digital data recording, Digital memory waveform recorder. **6 Hours**

Part – B

UNIT – 5

Transducers: Synchro's, Capacitance Transducers, Load cells, Piezo electrical Transducers, IC type temperature sensors, Pyrometers, Ultrasonic temperature Transducer, Reluctance pulse pick-ups, Flow measurement-mechanical Transducers; Magnetic flow meters, turbine flow meters. β-gauge.

8 Hours

UNIT – 6

Data acquisition and conversion: Generalized data acquisition system (DAS), Signal conditioning of inputs, single channel DAS, multi channel DAS, data loggers, compact data logger. **6 Hours**

UNIT – 7

Measurement of power: Measurement of large amount of RF power (calorimetric method),measurement of power on a transmission line, standing wave ratio measurements, measurement of standing wave ratio using directional couplers. **6 Hours**

UNIT – 8

Data transmission: Serial, asynchronous interfacing, data line monitors, RS-232 standard, universal serial bus,IEEE-1394.Long distance data transmission(modems).IEEE 488 bus. Electrical interface. **6 Hours**

TEXT BOOKS:

1.Electronic Instrumentation,H S Kalsi,TMH,3rd Edition,2010**.**

2.Modern Electronic Instrumentation and Measuring Techniques, Cooper D and A D Helfrick,PHI,2009

3. Stuent Reference Manual for Electronic Instrumentation Laboratories, Stanly Wolf,Richard F H,Smith,PHI,2nd Edition,2010.

10EE834 AI APPLICATIONS TO POWER SYSTEMS

Subject Code	:	10EE834	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

Part - A

UNIT - 1

Sparsity oriented Programming: Introduction, physical structure and sparsity, pivoting, conservation of sparsity by optimal ordering of buses, schemes for ordering, UD table storage scheme.

6 Hours

UNIT - 2

Artificial Intelligence: What is AI? Definitions, history and evolution, essential abilities of intelligence, AI applications; Problem solving: problem characteristics, problem search strategies, forward and backward reasoning, AND-OR graphs, game trees, search methods- informed and uninformed search, breadth first search and depth first search methods. **8 Hours**

UNIT – 3 and 4

Knowledge representation: logical formalisms: propositional and predicate logic: syntax and semantics, wffs, clause form expressions, resolution- use of RRTs for proofs and answers, examples from electric power systems, Non-monotonic logic: TMS, modal, temporal and fuzzy logic. **12 Hours**

Part – B

UNIT – 5

Structured representation of knowledge: ISA/ISPART trees, semantic nets, frames and scripts, examples from electric systems. **07 Hours**

UNIT – 6

Expert systems: Basic components, forward and backward chaining, ES features, ES development, ES categories, ES tools and examples from electric drive systems. **07 Hours**

UNIT –7 and 8

AI languages: LisP and ProLog - Introduction, sample segments, LisP primitives, list manipulation functions, function predicates, variables, iteration and recursion, property lists, sample programs for examples from electric power systems. **12 Hours**

REFERENCE BOOKS:

1. **Introduction to Artificial Intelligence and Expert Systems,** D.W.Patterson,PHI, 2009.
2. **Computer Methods for Circuit Analysis and Design,** J.Vlach and Singhal, CBS Publishers, 1986.
3. **Artificial Intelligence,** Rich, Elaine, Kevin Knight, TMH, 3rd Edition, 2008.
4. **Introduction to AI,** Charniak E. and Mcdermott D ,Pearson Education.
5. **Problem Solving Methods in AI,** Nils J.Nilson ,McGraw-Hill, 1971.
6. **Principles of AI,** Nils J.Nilson, Berlin Springer-Verlag, 1980

10EE835 DATA BASE MANAGEMENT SYSTEMS (DBMS)

Subject Code	:	**10EE835**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT- 1

INTRODUCTION TO DATA BASE SYSTEMS : Managing data, a historical perspective, File systems versus DBMS, Advantages of DBMS, Describing and Storing Data in DBMS, Queries in DBMS, Transaction management, Structure of DBMS, People who work with databases. **4 Hours**

UNIT -2

ENITTY – RELATIONSHIP MODEL : Using high- Level Conceptual Data Models for Database Design, An example of Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY database, ER Diagrams, Naming Conventions and Design Issues. **6 Hours**

Electronic Instrumentation

RELATIONAL MODEL AND RELATIONAL ALGEBRA: Relational model concepts, relational model constraints and relational database schemes, update operations and dealing with Constraint Violations, Unary relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, examples of Queries in Relational algebra, relational database design using ER-to-Relational mapping. **6 Hours**

UNIT- 4

SQL –THE RELATIONAL DATABASE STANDARD: SQL Data definition and data types, specifying basic constraints in SQL, Schemes, Change statements in SQL, basic Queries in SQL, more complex SQL queries, Insert, Delete and update statements in SQL, additional features SQL, specifying general constraints as assertion, views (virtual tables) in SQL, database Programming, issues and Techniques, Embedded SQL, Dynamic SQL, more examples; PL/SQL **10 Hours**

PART- B

UNIT- 5

DATABASE DESIGN: Informal Design Guidelines for Relation Schemes, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties of Relational Decompositions. **6 Hours**

UNIT- 6

b: Introduction Security, Access control, Discretionary Access, Mandatory Access Control **6 Hours**

UNIT – 7 & 8

TRANSACTION MANAGEMENT:The ACID properties, Transactions and Schedules, Concurrent Execution of transactions, Lock-based Concurrency control, performance of locking, Transaction support In SQL, Introduction to crash recovery; 2PL, for serializability and recoverability, Introduction to lock management, Lock Conversions, Dealing with Deadlocks, Specialized locking Techniques, Concurrency control without locking, Introduction to ARIES, The log, Other Recovery related Data Structures, The write-ahead log Protocol, Check pointing, Recovering from a System Crash, Media Recovery, Other Algorithms and Interaction with Concurrency control. **14 Hours**

TEXT BOOKS:

1. **Database Management Systems,** Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill, 3rd Edition, 2003.

.

2**. Fundamentals of Database Systems,** Elmasri and Navathe, Pearson Education, 5th Edition, 2003.

REFERENCE:

1**. Database System concepts,** Silberschatz Kortts Sudharshan , McGraw Hill, 5th edition,2006.

2. **Database System concepts,** Peter Rob, Carlos Coronel, Cengage Learning,First Edition,2008

10EE836 RENEWABLE ENERGY SOURCES

Subject Code	:	**10EE836**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

UNIT - 1

ENERGY SOURCES: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. **4 Hours**

UNIT - 2

SOLAR ENERGY BASICS: Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems); Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer. **6 Hours**

UNIT - 3

SOLAR THERMAL SYSTEMS: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses. **6 Hours**

UNIT - 4

SOLAR ELECTRIC SYSTEMS: Solar Thermal Electric Power Generation – Solar Pond and Concentrating Solar Collector (parabolic trough, parabolic dish, Central Tower Collector). Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems. **7 Hours**

ENERGY STORAGE: Introduction, Necessity of Energy Storage, and Methods of Energy Storage (classification and brief description using block diagram representation only). **3 Hours**

PART - B

UNIT - 5

WIND ENERGY: Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS, Wind site selection consideration, Advantages and Disadvantages of WECS. **8 Hours**

UNIT - 6

BIOMASS ENERGY: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. **6 Hours**

UNIT - 7

ENERGY FROM OCEAN: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Estimation of Energy – Single basin and Double basin type TPP (no derivations. Simple numerical problems), Advantages and Limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitations of OTEC. **6 Hours**

UNIT - 8

EMERGING TECHNOLOGIES: Fuel Cell, Small Hydro Resources, Hydrogen Energy, and Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations). **6 Hours**

TEXT BOOKS:

1. **Non-Conventional Sources of Energy,**Rai, G. D, Khanna Publishers, 4th Edition, 2007
2. **Non-Conventional Energy Resources,** Khan, B. H., TMH, 2nd Edition.

REFERENCE BOOK:

1. **Fundamentals of Renewable Energy Systems,** Mukherjee, D and Chakrabarti, S., New Age International Publishers, 2005.

ELECTIVE –V (GROUP - E)

10EE841 POWER SYSTEMS DYNAMICS AND STABILITY

Subject Code	:	**10EE841**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Basic concepts, Review of classical methods. **2 Hours**

UNIT - 2 & 3

SYSTEM MODELING AND DYNAMICS OF SYNCHRONOUS GENERATOR: Modeling of synchronous machine, Swing equation, Park's transformation – Park's voltage equation, Park's mechanical equation (torque). Applications – (a) Voltage build up in synchronous machine, and (b) Symmetrical short circuit of generator. Solution for transient analysis, Operational impedance, Relationship between Tdo/ and Tdo//, Algebraic constraints. **14 Hours**

UNIT - 4

EXCITATION AND PRIME MOVER CONTROLLERS: Introduction, Types of excitation, AVR with and without ESS, TGR, Amplifier PSS, Static exciters. **8 Hours**

PART - B

UNIT - 5

MODELING OF PRIME MOVERS: Introduction, Three major components, Block diagram, Hydraulic turbine, Steam turbine. **8 Hours**

UNIT - 6

LOAD MODELING: Introduction, Two approaches – Polynomial model and Exponential model. Small Signal Angle Stability: Small signal angle stability with SMIB system, detailed model of SMIB. **10 Hours**

UNIT - 7 & 8

TRANSIENT STABILITY ANALYSIS: Simulation for Transient stability Evaluation, Transient stability controllers. **10 Hours**

TEXT BOOKS:

1. **Power System Dynamics, Stability and Control**,Padiyar K.R., Interline Publications.
2. **Power System Stability and Control,** Prabha Kundur. TMH, 9th Reprint.

REFERENCE BOOKS:

1. **Dynamics and Control of Large Electric Power Systems,** Marija Ilic; John Zaborszky, , IEEE Press and John Wiley & Sons, Inc, 2007
2. **Power System Control and Stability Revised Printing,** Paul M. Anderson and A. A. Fouad, IEEE Press and John Wiley & Sons, Inc, 2002.
3. **Selected topics from IEEE Transaction and Conference Proceedings**

10EE842 ENERGY AUDITING & DEMAND SIDE MANAGEMENT

Subject Code	:	**10EE842**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation. **6 Hours**

UNIT - 2

ENERGY ECONOMIC ANALYSIS: The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems. **7 Hours**

UNIT - 3

ENERGY AUDITING: Introduction, Elements of energy audits, energy use profiles, measurements in energy audits, presentation of energy audit results. **8 Hours**

UNIT - 4

ELECTRICAL SYSTEM OPTIMIZATION: The power triangle, motor horsepower, power flow concept. **5 Hours**

PART - B

UNIT - 5 & 6

ELECTRICAL EQUIPMENT AND POWER FACTOR –correction & location of capacitors, energy efficient motors, lighting basics, electrical tariff, Concept of ABT. **10 Hours**

UNIT - 7 & 8

DEMAND SIDE MANAGEMENT: Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning, load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and Organization of Energy Conservation awareness Programs. **16 Hours**

TEXT BOOKS:

1. **Industrial Energy Management Systems,** Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York.

2. **Fundamentals of Energy Engineering -** Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.
3. **Electrical Power distribution**, A S. Pabla, TMH, 5th edition, 2004

REFERENCE BOOKS:

1. **Recent Advances in Control and Management of Energy Systems**, D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
2. **Energy Demand – Analysis, Management and Conservation,** Ashok V. Desai, Wiley Eastern, 2005.
3. **Demand Side Managementm,** Jyothi Prakash, TMH Publishers.
4. **Hand book on energy auditing -** TERI (Tata Energy Research Institute)

10EE843 DATA COMMUNICATIONS AND NETWORKING

Subject Code	:	**10EE843**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

I**NTRODUCTION**: Data Communications; Networks; the Internet; Protocols and Standards; Layered tasks; The OSI Model and the layers in the OSI model; TCP / IP Protocol Suite**. 6 Hours**

UNIT - 2

DATA, SIGNALS, AND DIGITAL TRANSMISSION : Analog and digital signals; Transmission impairment; Data rate limits; Performance; Digital-to-Digital conversion; Analog-to-Digital conversion; Transmission modes. **8 Hours**

UNIT - 3

ANALOG TRANSMISSION AND MULTIPLEXING: Digital - to - Analog conversion; Analog - to - Analog conversion; Multiplexing; Spread spectrum. **6 Hours**

UNIT - 4

TRANSMISSION MEDIA, ERROR DETECTION AND CORRECTION: Twisted pair cable, Coaxial cable, Fibre-Optic cable, Radio waves, Microwaves, Infrared. Introduction to error detection / correction; Block coding; Linear block codes; Cyclic codes, Checksum. **6 Hours**

PART - B

UNIT - 5

DATA LINK CONTROL: Framing; Flow and Error control; Protocols; Noiseless channels; Noisy channels; HDLC; Point-to-point Protocol - framing, transition phases. **7 Hours**

UNIT - 6

MULTIPLE ACCESS, ETHERNET: Random Access; Controlled Access; Channelization. Ethernet: IEEE standards; Standard Ethernet and changes in the standard; Fast Ethernet; Gigabit Ethernet. **7 Hours**

UNIT - 7

WIRELESS LANS AND CONNECTION OF LANS: IEE 802.11; Bluetooth. Connecting devices; Backbone Networks; Virtual LANs. **6 Hours**

UNIT - 8

OTHER TECHNOLOGIES: Cellular telephony; SONET / SDH: Architecture, Layers, Frames; STS multiplexing. ATM: Design goals, problems, architecture, switching, layers. **6 Hours**

TEXT BOOK:

1. **Data Communications and Networking** – Behrouz A. Forouzan, Tata McGraw-Hill, 4th Edition, , 2006.

REFERENCE BOOKS:

1. **Communication Networks: Fundamental Concepts and Key Architectures -** Alberto Leon, Garcia and Indra Widjaja, , Tata McGraw- Hill ,2nd Edition, 2004.
2. **Data and Computer Communication,** William Stallings, Pearson Education, 8th Edition, 2007.

3. **Computer Networks: A Systems Approach -** Larry L. Peterson and Bruce S. David, 4th Edition, Elsevier, 2007.
4. **Introduction to Data Communications and Networking** – Wayne Tomasi, Pearson Education, 2005.
5. **Computer and Communication Networks** – Nader F. Mir, Pearson Education, 2007.

10EE844 ELECTRICAL DISTRIBUTION SYSTEMS

Subject Code	:	**10EE844**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

POWER SYSTEM PLANNING AND AUTOMATION: Introduction, Factors affecting system planning, present planning techniques, planning models, future trends in planning, systems approach, distribution automation. **8 Hours**

UNIT - 2

LOAD CHARACTERISTIC: Basic definition, relation between load and load factor, load growth. **6 Hours**

UNIT - 3 & 4

3. SYSTEM PLANNING: Planning process, planning criteria, system developers, dispersed generation, distribution systems, economics and finance, mapping. **12 Hours**

PART - B

UNIT - 5 & 6

DESIGN AND OPERATION: Engineering design, operation criteria, substation and feeder, voltage control, harmonics, load variations, system losses, energy management. **10 Hours**

UNIT - 7

DISTRIBUTION AUTOMATION: Definitions, communication, sensors, SCADA. **8 Hours**

UNIT - 8

OPTIMIZATION: Introduction, costing of schemes, typical network configurations, planning terms, network cost modeling, synthesis of optimum line network. **8 Hours**

TEXT BOOKS:

1. **Electric power distribution system engineering,** Turan Gonen, CRC Press,2nd Edition.
2. **Electric power distribution**-A S. Pabla, TMH, 5th edition, 2004
3. **Hand Book of Electrical Power Distribution,** Gorti Ramamurthy,University Press,2nd Edition,2009.

10EE845 INSULATION ENGINEERING

Subject Code	:	**10EE845**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

ELECTROSTATIC FIELD, THEIR CONTROL AND ESTIMATIONS: Electric Field Intensity, Electric Strength, Classification of Electric Fields, Degree of Uniformity of Electric Fields, control of Electric field Intensity (stress control), Estimation of Electric Field Intensity, Basic Equations for potential and Field Intensity in Electrostatic Fields, Analysis of Electric Field Intensity in Homogeneous Isotropic single dielectric only direct solution of Laplace equation, Analysis of Electric field Intensity in Isotropic Multi dielectric system. **7 Hours**

UNIT - 2

INSULATION SYSTEM IN POWER SYSTEM APPARATUS: Insulation system in capacitors, bushings, and transformers modes of failure of insulation systems. Insulations used in rotating machines. **6 Hour**

UNIT - 3

DIELECTRIC PHENOMENA: Dielectric phenomena in in solid insulation. Macroscopic approach for describing the Dielectric phenomena microscopic treatment for Dielectric phenomena. **7 Hours**

UNIT - 4

PROPERTIES OF INSULATION MATERIALS: Introduction to properties of solid insulating materials (both of natural origin and synthetic types) Properties of liquid insulating materials. **6 Hours**

PART - B

UNIT - 5

GASEOUS INSULATION: Requirement of gaseous insulation. Breakdown process: types of collision, Elastic and inelastic, collision cross-section, Mobility of ions, Diffusion of charges, Emission of radiation and excitation, various secondary process and recombination, Mobility controlled and diffusion controlled breakdown. Gas insulated substations. **9 Hours**

UNIT – 6 ,7 and **8**

AGEING PHENOMENA: Failure of electric insulation due to ageing. Ageing mechanisms- Thermal ageing, Electrical ageing, combined thermal and electrical ageing.

Analysis of insulation failure data, Power law model, Graphical estimation of power law constants, ageing date, plotting position and cumulative probability. **17 Hours**

TEXT BOOKS:

1. **Fundamentals of gaseous ionization and plasma electronics,** Nasser E. John Wiley Interscience, New York, 1971.
2. **Methods of statistical analysis and life data,** Hann N.R. Schafer R.E. and Singapore wall N.D. John Wiley and sons, New York, 2002.
3. **Theory of electric polarization**, Bother C.J.F. Elsevier Publications.
4. **High Voltage Insulation Engineering,** Ravindra Arora, Wolfgang Mosch, New age International Publishers Ltd.

REFERENCE BOOKS:

1. Electrical insulation, Bradwell A. Peter Peregrinus Ltd, London, 1993.
2. Electrical breakdown of gases, J.M. Meek and J.D. Craggs, "Oxford university press, 11953
3. High voltage Engineering fundamentals, E. Kufell and W.S. Zaengl, and J. Kufell, 2nd edition, Elsevier 2005
4. High voltage Engineering, M.S. Naidu and V Kamaraju, TMH, 4th edition, 2008.
5. **Gas Insulated Substations**, M.S. Naidu,I K International Publishing House,2008 Edition.

10EE846 INTELLECTUAL PROPERTY RIGHTS

Subject Code	:	**10EE846**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

Introduction, Protection of Knowledge in general, International Treaties-Paries Convention, TRIPS-treaty. **4 Hour**

UNIT – 2

Intellectual Property Rights with exception of Patents – Copyright and neighboring rights, Auteurswet 1912, Neighboring rights, Database law, unified Benelux law relating to Trademarks, Trade Name law. **8 Hour**

UNIT – 3 and 4

Utility model,Unified Benelux law relating to Industrial Designs, Protection of Plant Varities, Topographies and Semiconductor Products, Countering inadmissible competition. **12 Hour**

PART – B

UNIT – 5

Legal Regulations relating to Patents – Strasbourg Treaty, European Patent convention, Patent Cooperation Treaty, Patent Law Treaty. **6 Hour**

UNIT – 6

Obtaining a European Patent-official procedure in Europe, Rights conferred by a European Patent Application or a European Patent, International Patent Application-Official International procedure, Rights conferred by an International Patent Application. **10 Hour**

UNIT – 7

Patent Systems in Germany and United Kingdom, Patent System in USA, Patent System in Japan, Patent System in India. **6Hour**

UNIT – 8

Selected Topics – Novelty and Incentive Step, Industrial Application, Supplementary Protection Certificates**,** What does a Patent Attorney do with patents? **6 Hour**

TEXT BOOKS:

1**. Intellectual Proper Law,** Narayan P, Eastern Law House(P)Ltd.
2**. Law of Patent,** Elizabeth Berti, Eastern Book Company,India,First Edition, 2005.
3. **Managing Intellectual Property-The Strategic Imperative**, Vonod V Sople,PHI,2008

REFERENCE BOOKS:

1. **Intellectual Property,** David Brainbridge, Pearson Education,5th Edition, Indian Reprint,2003**.**

10EE847 ELECTRICAL POWER QUALITY

Subject Code	:	**10EE847**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

Introduction, Power quality-voltage quality, power quality evaluation procedures term and definitions: general classes of power quality problems, transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion, power quality terms. **8 Hours**

UNIT - 2

VOLTAGE SAGS AND INTERRUPTIONS: Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, motor starting sags. **6 Hours**

UNIT - 3 & 4

TRANSIENT OVER VOLTAGES: Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients, Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion, intraharmonics. **10 Hours**

PART - B

UNIT - 5

APPLIED HARMONICS: Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics **8 Hours**

UNIT - 6

POWER QUALITY BENCHMARK: Introduction, benchmark process, power quality contract, power quality state estimation, including power quality in distribution planning. **6 Hours**

UNIT - 7

DISTRIBUTED GENERATION AND QUALITY: DG technologies, interface to utility system, power quality issues, interconnection standards. **6 Hours**

UNIT - 8

POWER QUALITY MONITORING: Monitoring considerations, power quality measurement equipments, assessment of power quality measurement data, application of intelligent systems, power quality monitoring standards. **8 Hours**

TEXT BOOK:

1. **Electric Power Quality,**Dugan, Roger C, Santoso, Surya, McGranaghan, Mark F/ Beaty, H. Wayne McGraw-Hill professional publication 2003.

REFERENCE BOOKS:

1. **Electric Power Quality,** G.T.Heydt, stars in a circle publications 1991.
2. **Modern Power Electronics,** M.H.Rashid TATA McGraw Hill 2002.
3. **Understanding power quality problems voltage sags and interruptions-** Math H. J. Bollen. IEEE Press, 2000
4. **Power quality in power systems and electrical machines,** Ewald F Fuchs ,Mohammad A.S., Masoum,Academic Press,Elsevier,2009.

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