FINAL **SCHEME OF TEACHING & EXAMINATION- Dated 16th and 17th April 2010**

SCHEME OF TEACHING & EXAMINATION

III SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT - 31	Engineering Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Circuits	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10EE– 35	Electrical and Electronic Measurements And Instrumentation	E&EE	04		03	25	100	125
10EE – 36	Electric Power Generation	E&EE	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : **@** indicates concerned discipline. ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to electrical and electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

FINAL **SCHEME OF TEACHING & EXAMINATION- Dated 16th and 17th April 2010**

IV SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT - 41	Engineering Mathematics - IV	Mat	04		03	25	100	125
10ES– 42	Microcontrollers	@	04		03	25	100	125
10ES – 43	Control Systems	@	04		03	25	100	125
10EE – 44	Field Theory	E&EE	04		03	25	100	125
10EE– 45	Power Electronics	E&EE	04		03	25	100	125
10EE – 46	Transformers and Induction Machines	E&EE	04		03	25	100	125
10ESL – 47	Microcontrollers Lab	@		03	03	25	50	75
10EEL – 48	Power Electronics Lab	E&EE		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : **@** indicates concerned discipline.ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to electrical and electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

FINAL **SCHEME OF TEACHING & EXAMINATION- Dated 16th and 17th April 2010**

V SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	@	4	-	3	25	100	125
02	10EE52	Signals and Systems	E&EE	4	-	3	25	100	125
03	10EE53	Transmission and Distribution	E&EE	4	-	3	25	100	125
04	10EE54	D.C. Machines and Synchronous Machines	E&EE	4	-	3	25	100	125
05	10EE55	Modern Control theory	E&EE	4	-	3	25	100	125
06	10EE56	Linear IC's and Applications	E&EE	4	-	3	25	100	125
07	10EEL57	Measurements and Circuit Simulation Laboratory	E&EE	-	3	3	25	50	75
08	10EEL58	Transformers and Induction Machines Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

@ Any Engineering department or department of Business study.

FINAL SCHEME OF TEACHING & EXAMINATION- Dated 16th and 17th April 2010

VI SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE61	Power System Analysis and Stability	E&EE	4	-	3	25	100	125
2	10EE62	Switchgear & Protection	E&EE	4	-	3	25	100	125
3	10EE63	Electrical Machine Design	E&EE	4	-	3	25	100	125
4	10EE64	Digital Signal Processing	E&EE	4	-	3	25	100	125
5	10EE65	Computer Aided Electrical Drawing	E&EE	1	3	3	25	100	125
6	10EE66X	Elective-I (Group A)	E&EE	4	-	3	25	100	125
7	10EEL67	D.C. Machines and Synchronous Machines Laboratory	E&EE	-	3	3	25	50	75
8	10EEL68	Control Systems Laboratory	E&EE	-	3	3	25	50	75
Total				21	09	24	200	700	900

Elective-I (Group A)

10EE661-Opration Research
10EE662 - Advanced Power Electronics
10EE663 – Fuzzy Logic
10EE664 - Object Oriented Programming using C++
10EE665 - Embedded Systems
10EE666 – Electrical Engineering Materials

FINAL **SCHEME OF TEACHING & EXAMINATION- Dated 16th and 17th April 2010**

VII SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE71	Computer Techniques in Power System Analysis	E&EE	4	-	3	25	100	125
2	10EE72	Electrical Power Utilization	E&EE	4	-	3	25	100	125
3	10EE73	High Voltage Engineering	E&EE	4	-	3	25	100	125
4	10EE74	Industrial Drives and Applications	E&EE	4	-	3	25	100	125
5	10EE75X	Elective-II (Group B)	E&EE	4	-	3	25	100	125
6	10EE76X	Elective-III (Group C)	E&EE	4	-	3	25	100	125
7	10EEL77	Relay and High Voltage Laboratory	E&EE	-	3	3	25	50	75
8	10EEL78	Power System Simulation Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

Elective-II (Group B)
10EE751 - HVDC Transmission
10EE752 - Programmable Logic Controllers
10EE753 - Artificial Neural Network
10EE754 - Operating System
10EE755 - Digital System with VHDL
10EE756 - Testing and Commissioning of Electrical Equipment

Elective-III (Group C)
10EE761 - Power System Planning
10EE762 - Computer Control of Electrical Drives
10EE763 - Data Structure
10EE764 - VLSI Circuits and Design
10EE765 - Micro & Smart System Technology
10EE766 - Electromagnetic Compatibility

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VIII SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE81	Electrical Design, Estimation and Costing	E&EE	4	-	3	25	100	125
2	10EE82	Power System Operation and Control	E&EE	4	-	3	25	100	125
3	10EE83X	Elective-IV (Group D)	E&EE	4	-	3	25	100	125
4	10EE84X	Elective-V (Group E)	E&EE	4	-	3	25	100	125
5	10EEP85	Project Work	E&EE	-	6	3	100	100	200
6	10EES86	Seminar (on a latest topic relevant to the branch and independent of the project work)	E&EE	-	3	-	50	-	50
Total				16	09	15	250	500	750

Elective-IV (Group-D)
10EE831 - Reactive Power Management
10EE832 - Flexible A.C. Transmission Systems (FACTS)
10EE833- Advanced Instrumentation System
10EE834 - AI Applications to Power Systems
10EE835 - Data Base Management Systems (DBMS)
10EE836 - Renewable Energy Sources

Elective-V (Group-E)
10EE841 - Power Systems Dynamics and Stability
10EE842 - Energy Auditing & Demand Side Management
10EE843 - Data communications and Networking
10EE844 - Electrical Distribution Systems
10EE845 - Insulation Engineering
10EE846 - Intellectual Property Rights
10EE847 - Electrical Power Quality

ENGINEERING MATHEMATICS – III

CODE: 10 MAT 31 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Hrs: 52 **Exam Marks:100**

PART-A

Unit-I: FOURIER SERIES

Convergence and divergence of infinite series of positive terms, definition and illustrative examples*
Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. **[7 hours]**

Unit-II: FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms **[6 hours]**

Unit-III: APPLICATIONS OF PDE

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'Alembert's solution of one dimensional wave equation.

[6 hours]

Unit-IV: CURVE FITTING AND OPTIMIZATION

Curve fitting by the method of least squares- Fitting of curves of the form $y = ax+b$, $y = a x^2 + b x + c$, $y = a e^{bx}$, $y = ax^b$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method.

[7 hours]

PART-B

Unit-V: NUMERICAL METHODS - 1

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

[6 hours]

Unit-VI: NUMERICAL METHODS – 2

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

[7 hours]

Unit-VII: NUMERICAL METHODS – 3

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations **[7 hours]**

Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

Note: * In the case of illustrative examples, questions are not to be set.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

ENGINEERING MATHEMATICS – IV

CODE: 10 MAT 41 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Hrs: 52 **Exam Marks:100**

PART-A

Unit-I: NUMERICAL METHODS - 1

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

Unit-II: NUMERICAL METHODS – 2

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.
Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

[6 hours]

Unit-III: Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.
Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

Unit-IV: Complex variables – 2

Conformal Transformations: Bilinear Transformations. Discussion of Transformations: $w = z^2$, $w = e^z$, $w = z + (a^2 / z)$. Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

[7 hours]

PART-B

Unit-V: SPECIAL FUNCTIONS

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

Unit-VI: PROBABILITY THEORY - 1

Probability of an event, empherical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

Unit-VII: PROBABILITY THEORY- 2

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

[7 hours]

Unit-VIII: SAMPLING THEORY

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

[6 hours]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus-Dated 16th and 17th April 2010

SCHEME OF TEACHING & EXAMINATION

III SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT31	Engineering Mathematics - III	Mat	04	-	03	25	100	125
10ES32	Analog Electronic Circuits	@	04	-	03	25	100	125
10ES33	Logic Design	@	04	-	03	25	100	125
10ES34	Network Analysis	@	04	-	03	25	100	125
10EE35	Electrical and Electronic Measurements And Instrumentation	E&EE	04	-	03	25	100	125
10EE36	Electric Power Generation	E&EE	04	-	03	25	100	125
10ESL37	Analog Electronics Lab	@	-	03	03	25	50	75
10ESL38	Logic Design Lab	@	-	03	03	25	50	75
		Total	24	06	24	200	700	900

Note : **@** indicates concerned discipline. ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to electrical and electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

10MAT31 ENGINEERING MATHEMATICS – III

Subject Code	:	**10MAT31**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES32 ANALOG ELECTRONIC CIRCUITS
(Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	**10ES32**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES33 LOGIC DESIGN (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES33	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES34 NETWORK ANALYSIS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES34	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:

Basic Concepts: Basic definitions. Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

7 Hours

UNIT 2:

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, solution of resistive networks, principle of duality**.**

7 Hours

UNIT 3:

Network Theorems – 1: Superposition, Reciprocity and Millman's theorems

6 Hours

UNIT 4:

Network Theorems - II:

Thevenin's and Norton's theorems, Maximum Power transfer theorem

6 Hours

PART – B

UNIT 5:

Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Q factor, Bandwidth. **6Hours**

UNIT 6:

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. **7 Hours**

UNIT 7:

Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis

7 Hours

UNIT 8:

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets

6 Hours

TEXT BOOKS:

1. **Engineering Circuit Analysis,** Hayt, Kemmerly and Durbin,TMH ,7th Edition, 2010
2. **Networks and systems,** Roy Choudhury, New Age International Publications.,2nd edition, 2006 re-print,

REFERENCE BOOKS:

1. **Electric Circuits,** Schaum's Outlines,M Nahvi & J A Edminister,TMH,5th Edition,2009**.**
2. **Network Analysis,** M. E. Van Valkenburg, PHI, 3rd Edition, Reprint 2009.
3. **Analysis of Linear Systems**, David K. Cheng, Narosa Publishing House, 11th reprint, 2002

10EE35 ELECTRICAL and ELECTRONIC MEASUREMENTS and INSTRUMENTATION

Subject Code	:	10EE35	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:

1-(a) Units and Dimensions: Review of fundamental and derived units. S.I. units. Dimensional equations, problems. **3 Hours**

1-(b) Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance, measurement by fall of potential method and by using Megger. **3 Hours**

UNIT 2:

Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance &capacitance bridge,Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. **07 Hours**

UNIT 3:

Extension of Instrument Ranges: Shunts and multipliers. Construction and theory of instrument transformers, Equations for ratio and phase angle errors of C.T. and P.T (derivations excluded). Turns compensation, illustrative examples (excluding problems on turns compensation),Silsbees's method of testing CT. **07 Hours**

UNIT 4:

Measurement of Power and Energy: Dynamometer wattmeter. UPF and LPF wattmeters, Measurement of real and reactive power in three-phase circuits. Induction type energy meter — construction, theory, errors, adjustments and calibration. Principle of working of electronic energy meter. 0**6 Hours**

PART – B

UNIT 5:

(a) Construction and operation of electro-dynamometer single-phase power factor meter. Weston frequency meter and phase sequence indicator. 0**4 Hours**

(b) Electronic Instruments: Introduction. True RMS responding voltmeter. Electronic multimeters. Digital voltmeters. Q meter. 0**4 Hours**

UNIT 6:

Dual trace oscilloscope — front panel details of a typical dual trace oscilloscope. Method of measuring voltage, current, phase, frequency and period. Use of Lissajous patterns. Working of a digital storage oscilloscope. Brief note on current probes. 0**6 Hours**

UNIT 7:

Transducers: Classification and selection of transducers. Strain gauges. LVDT. Measurement of temperature and pressure. Photo-conductive and photo-voltaic cells.

0**6 Hours**

UNIT 8:

(a) Interfacing resistive transducers to electronic circuits. Introduction to data acquisition systems.

2 Hours

(b) Display Devices and Signal Generators: X-Y recorders. Nixie tubes. LCD and LED display. Signal generators and function generators. **4 Hours**

Text Books

1. **Electrical and Electronic Measurements and Instrumentation,** A. K. Sawhney, Dhanpatrai and Sons, New Delhi.
2. **Modern Electronic Instrumentation and Measuring Techniques,** Cooper D. and A.D. Heifrick, PHI, 2009 Edition.

References

1. **Electronic Instrumentation and Measurement,** David A. Bell, oxford Publication ,2nd Edition, 2009.
2. **Electrical Measurements and Measuring Instruments,** Golding and Widdies, Pitman

10EE36 ELECTRIC POWER GENERATION

Subject Code	:	10EE36	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:

Sources of Electrical Power: Wind, solar, fuel cell, tidal, geo-thermal, hydro-electric, thermal-steam, diesel, gas, nuclear power plants (block diagram approach only). Concept of co-generation. Combined heat and power distributed generation. 06 **Hours**

UNIT 2:

Diesel electric plants. Gas turbine plants. Mini, micro, and bio generation. Concept of distributed generation. 06 **Hours**

UNIT 3:

(a) Hydro Power Generation: Selection of site. Classification of hydro-electric plants. General arrangement and operation. Hydroelectric plant power station structure and control. 5 **Hours**

(b) Thermal Power Generation: Introduction. Main parts of a thermal power plant. Working. Plant layout. **3 Hours**

UNIT 4:

Nuclear Power Station: Introduction. Pros and cons of nuclear power generation. Selection of site, cost, components of reactors. Description of fuel sources. Safety of nuclear power reactor. **6 Hours**

PART – B

UNIT 5 and 6:

(a) Economics Aspects: Introduction. Terms commonly used in system operation. Diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor and loss factor, load duration curve. Cost of generating station, factors influencing the rate of tariff designing, tariff, types of tariff**.** Power factor improvement.

(b) Substations: Introduction, types, Bus bar arrangement schemes, Location of substation equipment. Reactors and capacitors. Interconnection of power stations. 1**4 Hours**

UNIT 7 and 8 :

Grounding Systems: Introduction, grounding systems. Neutral grounding. Ungrounded system. Resonant grounding. Solid grounding, reactance grounding, resistance grounding. Earthing transformer. Neutral grounding transformer. **12 Hours**

Text Books

1. **Power System Engineering,** A. Chakrabarti, M. L. Soni, and P.V. Gupta, Dhanpat Rai and Co.,NewDelhi.

2. **Electric Power Generation, Transmission and Distribution,** S**.** N. Singh, PHI, 2nd Edition,2009.

References

1. **Elements of Electrical Power System Design,** M. V. Deshpande, PHI,2010

10ESL37 ANALOG ELECTRONICS LAB (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	**10EEL37**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

10ESL38 LOGIC DESIGN LAB (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	**10EEL38**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

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FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010

IV SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT 41	Engineering Mathematics - IV	Mat	04	-	03	25	100	125
10ES42	Microcontrollers	@	04	-	03	25	100	125
10ES43	Control Systems	@	04	-	03	25	100	125
10EE44	Field Theory	E&EE	04	-	03	25	100	125
10EE45	Power Electronics	E&EE	04	-	03	25	100	125
10EE46	Transformers and Induction Machines	E&EE	04	-	03	25	100	125
10ESL47	Microcontrollers Lab	@	-	03	03	25	50	75
10EEL48	Power Electronics Lab	E&EE	-	03	03	25	50	75
		Total	24	06	24	200	700	900

Note : **@** indicates concerned discipline. ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to Electrical and Electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

10MAT41 ENGINEERING MATHEMATICS – IV

Subject Code	:	**10MAT41**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES 42 MICROCONTROLLERS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	**10ES42**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES43 CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES43	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:
Modeling of Systems: Introduction to Control Systems, Types of control systems, Effect of feedback systems, Differential equations of physical systems – Mechanical systems- Friction, Translational systems (Mechanical accelerometer, Levered systems excluded), Rotational systems, Gear trains. Electrical systems, Analogous systems. **6 Hours**

UNIT 2:
Block diagrams and signal flow graphs: Transfer functions, Block diagrams, Signal Flow graphs (State variable formulation excluded). **7 Hours**

UNIT 3:
Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. **7Hours**

UNIT 4:
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh-Hurwitz stability criterion, Relative stability analysis; Special cases of RH criterion. **6 Hours**

PART – B

UNIT 5:
Root–Locus Techniques: Introduction, basic properties of root loci, Construction of root loci. **6 Hours**

UNIT 6:
Stability analysis in frequency domain: Introduction, Mathematical preliminaries, Nyquist Stability criterion, (Inverse polar plots excluded), Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded). **7Hours**

UNIT 7:
Frequency domain analysis: Correlation between time and frequency response, Bode plots, All pass and minimum phase systems, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. **7 Hours**

UNIT 8:
Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations. **6 Hours**

TEXT BOOK :

1. Control Systems Engineering, I. J. Nagarath and M.Gopal, New Age International (P) Limited, 4th Edition – 2005

2 Modern Control Engineering, K. Ogata, PHI, 5th Edition, 2010.

REFERENCE BOOKS:

1. **Control Systems Engineering,**Norman S Nise,Wiley Student Edition,5th Edition,2009
2. **Automatic Control Systems**, Benjamin C.Kuo and Farid Golnaaghi, Wiley Student Edition,8th Edition,2009
3. **Feedback and Control Systems**,Joseph J Distefano III and other, Schaum's Outlines,TMH,2nd Edition,2007
4. **Control Systems**, Ananda Kumar, PHI,2009.

10EE44 FIELD THEORY

Subject Code	:	10EE44	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

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge. **03 Hours**

b. **Electric flux density, Gauss' law and divergence:** Electric flux density, Gauss' law, Divergence, Maxwell's First equation (Electrostatics), vector operator and divergence theorem **04 Hours**

UNIT- 2

a. **Energy and potential:** Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient, Energy density in an electrostatic field **04 Hours**

b. Conductors, dielectrics and capacitance: Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples. **03 Hours**

UNIT- 3

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations. **06 Hours**

UNIT -4

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials. **06 Hours**

PART – B

UNIT- 5

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

03 Hours

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

04 Hours

UNIT-6

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

06 Hours

UNIT- 7

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors, skin effect.

07HOURS

UNIT- 8

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions. **06 Hours**

TEXT BOOK:

1. **Engineering Electromagnetics,** William H Hayt Jr. and John A Buck**,** Tata McGraw-Hill, 7th edition, 2009.
2. **Principles of Electromagnetics,** Matthew N.O. Sadiku, 4th Edition, Oxford University Press, 2009.

REFERENCE BOOKS:

1. **Electromagnetics with Applications,** John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999.
2. **Electromagnetism-Theory and Applications,** Ashutosh Pramanik, PHI, 2nd edition,Reprint 2009.
3. **Field and Wave Electromagnetics**, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

10EE45 POWER ELECTRONICS

Subject Code	:	10EE45	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 Semiconductor Devices:

Introduction to semiconductors, Power Electronics, Power semiconductor devices, Control Characteristics. Types of power electronic converters and industrial applications-Drives, Electrolysis, Heating, Welding, Static Compensators, SMPS, HVDC power transmission, Thyristorized tap changers and Circuit breakers.

7 hours

UNIT 2:

Power Transistors: Power BJT's – switching characteristics, switching limits, base drive control. Power MOSFET's and IGBT's –characteristics, gate drive , di/dt and dv/dt limitations. Isolation of gate and base drives. Simple design of gate and base drives. **6 Hours**

UNIT 3:

Thyristors

Introduction, Two Transistor Model, characteristics-static and dynamic. di/dt and dv/dt protection. Ratings of thyristors. Thyristor types. Series and parallel operation of Thyristors. Thyristor firing circuits. Design of firing circuits using UJT, R, R-C circuits. Analysis of firing circuits using operational amplifiers and digital IC's. **7 Hours**

UNIT 4:

Commutation Techniques: Introduction. Natural Commutation. Forced commutation- self-commutation, impulse commutation, resonant pulse commutation and complementary commutation. **6 Hours**

PART – B

UNIT 5:

Controlled Rectifiers: Introduction. Principle of phase controlled converter operation. Single- phase semi-converters. Full converters. Three-phase half-wave converters. Three-phase full-wave converters. **7 Hours**

UNIT 6:

Choppers: Introduction. Principle of step-down and step-up chopper with R-L load. Performance parameters. Chopper classification. Analysis of impulse commutated thyristor chopper (only qualitative analysis) **6 Hours**

UNIT 7:

Inverters: Introduction. Principle of operation. Performance parameters. Single-phase bridge inverters. Threephase inverters. Voltage control of single-phase inverters – single pulse width, multiple pulse width, and sinusoidal pulse width modulation. Current source inverters. **7 Hours**

1

UNIT 8:

(a)AC Voltage Controllers: Introduction. Principle of ON-OFF and phase control. Single-phase, bi-directional controllers with resistive and R-L loads.

(b) Electromagnetic Compatibility: Introduction, effect of power electronic converters and remedial measures.

6 Hours

Text Book:

1. **Power Electronics,** M.H.Rashid, , Pearson, 3rd Edition, 2006.

2. **Power Electronics,** M.D. Singh and Khanchandani K.B., T.M.H., 2nd Edition,2001

References

1. **Power Electronics Essentials and Applications**,L.Umanand, Wiley India Pvt Ltd,Reprint,2010
2. **Thyristorised Power Controllers,** G.K. Dubey, S.R. Doradla, A. Joshi and R.M.K. Sinha, New Age International Publishers.
3. **Power Electronics – Converters, Applications and Design,** Ned Mohan, Tore M. Undeland, and William P. Robins, Third Edition, John Wiley and Sons,2008.
4. **Power Electronics: A Simplified Approach,** R.S. Ananda Murthy and V. Nattarasu, pearson/Sanguine Technical Publishers.

10EE46 TRANSFORMERS AND INDUCTION MACHINES

Subject Code	:	10EE46	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:

Basic Concepts: Principle of operation of transformer, Constructional details of shell type and core type single-phase and three-phase transformers. EMF equation, operation of practical power transformer under

no load and on load (with phasor diagrams).Concept of ideal transformers, current inrush in transformers. **6 Hours**

UNIT 2:

Single-phase Transformers: Equivalent circuit, losses, efficiency, condition for maximum efficiency, all day efficiency. Open circuit and Short circuit tests, calculation of parameters of equivalent circuit. Regulation, predetermination of efficiency and regulation. Polarity test, Sumpner's test.

6 Hours

UNIT 3:

Parallel operation - need, conditions to be satisfied for parallel operation. Load sharing in case of similar and dissimilar transformers. Auto-transformers, copper economy. Brief discussion on constant voltage transformer, constant current transformer. **6 Hours**

UNIT 4:

Three-phase Transformers: Introduction, choice between single unit three-phase transformer and bank of single-phase transformers. Transformer connection for three phase operation – star/star,delta/delta,star/delta,zigzag/star and vee/vee,choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, phase shift between primary and secondary and vector groups. Conditions for parallel operation of three-phase transformers,load sharing. Equivalent circuit of three-phase transformer. **8 Hours**

PART – B

UNIT 5:

Basic Concepts of three phase Induction Machines: Concept of rotating magnetic field. Principle of operation, construction, classification and types - single-phase, three-phase, squirrel-cage, slip-ring. Slip, torque, torque-slip characteristic covering motoring, generating and braking regions of operation. Maximum torque**.** **7 Hours**

UNIT 6:

Three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load. equivalent circuit Losses, efficiency, No-load and blocked rotor tests. Circle diagram and performance evaluation of the motor. Cogging and crawling. **6Hours**

UNIT 7:

High torque rotors-double cage and deep rotor bars.Equivalent circuit and performance evaluation of double cage induction motor. Induction generator – externally excited and self excited. Importance of induction generators in windmills. **6 Hours**

UNIT 8:

(a) Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line (DOL), Star-Delta and autotransformer starting. Rotor resistance starting. Soft(electronic) starters. Speed control - voltage, frequency, and rotor resistance. **4 Hours**

(b) Single-phase Induction Motor: Double revolving field theory and principle of operation. Types of single-phase induction motors: split-phase, capacitor start, shaded pole motors. Applications. **3 Hours**

Text Books

1. **Electric Machines,** I. J. Nagrath and D. P. Kothari, T.M.H,4th Edition,2010.
2. **Electric Machines,** Mulukuntla S.Sarma, Mukesh K.Pathak, Cengage Learing,First edition,2009.

References

1. **Performance and Design of A.C. Machines,** M. G. Say,C.B.S. Publishers, 3rd Edition,2002.
2. **Theory of Alternating Current Machines,** Alexander Langsdorf, T.M.H, 2nd edition,2001..
3. **Electrical Machines and Transformers,** Kosow, Pearson, 2nd edition, 2007.
4. **Transformers,** BHEL, TMH,2nd Edition, Eight reprint 2008.

10ESL47 MICROCONTROLLERS LAB (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	**10EEL47**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

10EEL48 POWER ELECTRONICS LAB

Subject Code	:	**10EEL48**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Static characteristics of SCR.
2. Static characteristics of MOSFET and IGBT.
3. SCR turn-on circuit using synchronized UJT relaxation oscillator.
4. SCR Digital triggering circuit for a single-phase controlled rectifier and A.C. voltage controller.
5. Single-phase controlled full-wave rectifier with *R* and *R-L* loads.
6. A.C. voltage controller using TRIAC and DIAC combination connected to *R* and *R-L* loads.
7. Speed control of a separately excited D.C. motor using an IGBT or MOSFET chopper.
8. Speed control of D.C. motor using single semi converter
9. Speed control of a stepper motor.
10. Speed control of universal motor using A.C. voltage controller.
11. MOSFET OR IGBT based single-phase full-bridge inverter connected to R load.
12. Study of commutation using LC circuits and auxiliary circuits.

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FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010

V SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	@	4	-	3	25	100	125
02	10EE52	Signals and Systems	E&EE	4	-	3	25	100	125
03	10EE53	Transmission and Distribution	E&EE	4	-	3	25	100	125
04	10EE54	D.C. Machines and Synchronous Machines	E&EE	4	-	3	25	100	125
05	10EE55	Modern Control theory	E&EE	4	-	3	25	100	125
06	10EE56	Linear IC's and Applications	E&EE	4	-	3	25	100	125
07	10EEL57	Measurements and Circuit Simulation Laboratory	E&EE	-	3	3	25	50	75
08	10EEL58	Transformers and Induction Machines Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

@- Any Engineering department or department of Business study.

10AL51 Management and Entrepreneurship

Subject Code	:	**10AL51**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10EE52 SIGNALS AND SYSTEMS

Subject Code	:	**10EE52**	**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-Definitions of signals and a system, classification of signals, basic operations on signals, elementary signals viewed as interconnections of operations, properties of systems. **10 Hours**

UNIT – 2 and 3

TIME – DOMAIN REPRESENTATIONS FOR LTI SYSTEMS-Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. **10 Hours**

UNIT - 4

FOURIER REPRESENTATION OF PERIODIC SIGNALS-Introduction, Fourier representation of continuous-time periodic signals (FS), properties of continuous-time Fourier series (excluding derivation of defining equations for CTFS), Fourier representation of discrete-time periodic signals, properties of discrete-time Fourier series (DTFS). **6 Hours**

PART - B

UNIT - 5

THE CONTINUOUS-TIME FOURIER TRANSFORM-Representation of a periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform. Application; frequency response of LTI systems, Solutions of differential equations. **7 Hours**

UNIT - 6

THE DISCRETE-TIME FOURIER TRANSFORM-Representations of periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT. Application; frequency response of LTI systems, Solutions of differential equations. **7 Hours**

UNIT –7 and 8

Z- TRANSFORMS-Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. **12 Hours**

TEXT BOOKS:

1. **Signals and Systems**- Simon Haykin and Barry Van Veen, John Wiley & Sons, 2nd Edition 2008.
2. **Fundamentals of Signals and Systems** - Michel J Roberts, TMH, 2nd Edition,2010.

REFERENCE BOOKS:

1. **Signals and Systems**, Alan V Oppenheim, Alan S. Willsky and S. Hamid Nawab,PHI, 2nd edition, 2009.
2. **Signals and Systems,** H P Hsu and others, Schaums Outline Series, TMH,2nd Edition,2008.

10EE53 TRANSMISSION AND DISTRIBUTION

Subject Code	:	10EE53	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

TYPICAL TRANSMISSION & DISTRIBUTION SYSTEMS SCHEME-General layout of power system, Standard voltages for transmission, advantages of high voltage transmission. Transmission line efficiency and line drop. Feeders, distributors & service mains. **5 Hours**

UNIT - 2

OVERHEAD TRANSMISSION LINES- Types of supporting structures and line conductors used. Sag calculation- supports at same level and at different levels. Effect of wind and ice, Sag at erection, Stringing chart and sag templates. Line vibrators. **5 Hours**

UNIT – 3

INSULATORS- Introduction, materials used, types, potential distribution over a string of suspension insulators. String efficiency & methods of increasing strings efficiency, grading rings and arcing horns. Testing of insulators. **6 Hours**

UNIT - 4

(A)CORONA- Phenomena, disruptive and visual critical voltages, corona power loss. Advantages and disadvantages of corona. **4 Hours**

(B)**UNDERGROUND CABLES**- Types, material used, insulation resistance, thermal rating of cables, charging current, grading of cables, capacitance grading & inter sheath grading, testing of cables. **6 Hours**

Part - B

UNIT – 5 and 6

Line parameters: calculation of inductance of single phase line, 3phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite conductor lines. Capacitance- of single-phase line, 3phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite conductor lines. **12 Hours**

UNIT - 7

Performance of power transmission lines- Short transmission lines, medium transmission lines- nominal T, end condenser and π models, long transmission lines, ABCD constants of transmission lines, Ferranti effect, line regulation. **8 Hours**

UNIT - 8

Distribution- Requirements of power distribution, radial & ring main systems, ac and dc distribution: calculation for concentrated loads and uniform loading. **6 Hours**

TEXT BOOKS:

1. **A Course in Electrical Power**- Soni Gupta & Bhatnaagar, Dhanpat Rai & Sons.
2. **Electrical Power Systems**- C. L. Wadhwa, New Age International,5th Edition,2009.

REFERENCE BOOKS:

1. **Elements of Power System Analysis**- W.D. Stevenson, TMH,4th Edition
2. **Electric power generation Transmission & Distribution**- S. M. Singh, PHI,2nd Edition, 2009.
3. **Electrical Power-** Dr. S. L. Uppal, Khanna Publications

10EE54 D.C. MACHINES AND SYNCHRONOUS MACHINES

Subject Code	:	10EE54	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

DC GENERATOR-Review of basics of DC machines, classification of DC generator, types of armature winding, EMF equation, no-load characteristic, armature reaction, load characteristics. Commutation, types of Commutation, commutation difficulties, interpoles, compensating winding and equalizer rings (only qualitative treatment).

8 Hours

UNIT - 2

DC Motors- (a) Classification, Back EMF and its significance, Torque equation, Characteristics of shunt, series & compound motors, speed control of shunt, series and compound motors.Application of motors. DC motor starters

(b) Special DC motors- permanent magnet motors,brushless DC motors.Applications. **8 Hours**

UNIT – 3 and 4

LOSSES AND EFFICIENCY- Losses in DC machines, power flow diagram, efficiency, condition for maximum efficiency.

TESTING OF DC MACHINES- Direct & indirect methods of testing of DC machines-Brake test, Swinburn's test, Hopkinson's test, Retardation test, Field's test, merits and demerits of tests.

10 Hours

PART - B

UNIT - 5

SYNCHRONOUS MACHINES- Basic principle of operation, construction of salient & non-salient pole synchronous machines, generated EMF, effect of distribution and chording of winding, harmonics-causes, reduction and elimination. Armature reaction, synchronous reactance, leakage reactance, phasor diagram of non salient type alternator. **5 Hours**

UNIT - 6

VOLTAGE REGULATION: Voltage regulation by EMF, MMF, ZPF & ASA method.Schort circuit ratio and its importance.Two reaction theory-direct and quadrature axis reactances,phasor diagram.Slip test and regulation. **8 Hours**

UNIT - 7

Synchronizing to infinite bus bars, parallel operation of alternators. Operating characteristics, power angle characteristics excluding armature resistance, operation for fixed input and variable excitation, power flow equations including armature resistance, capability curves of synchronous generators. **6 Hours**

UNIT - 8

SYNCHRONOUS MOTOR: Principle of operation, phasor diagrams, torque and torque angle, Blondal diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condensor, hunting and damping. Methods of starting synchronous motors. 7 Hours

TEXT BOOKS:

1. **Electrical machinery,** P.S Bhimbra, Khanna Publishers
2. **Electrical machines,** DP Kothari, I.J.Nagarath, TMH, 4th edition, 2010.
3. **Electric Machines,** Mulukuntla S.Sarma, Mukesh K.Pathak, Cengage Learning, First edition,2009.

REFERENCE BOOKS:

1. **Performance & Design of Alternating Current machines**, M. G. Say, CBS publishers,3rd Edition,2002.
2. **The Performance & Design of DC machines** A.E Clayton & N.N.Hancock CBS Publication,3rd Edition,2004.
3. **Electrical Machines**,Ashfaq Hussain, Dhanpat Rai Publications.

10EE55 MODERN CONTROL THEORY

Subject Code	:	10EE55	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 and 2

STATE VARIABLE ANALYSIS AND DESIGN: Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. **10 Hours**

UNIT - 3

Derivation of transfer function from state model, diagolization, Eigen values, Eigen vectors, generalized Eigen vectors. **6 Hours**

UNIT - 4

Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same. **10 Hours**

PART - B

UNIT - 5

POLE PLACEMENT TECHNIQUES: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P, PI, PID. **10 Hours**

UNIT - 6

Non-linear systems: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity.**3 Hours**

U**NIT - 7**

Phase plane method, singular points, stability of nonlinear system, limit cycles, construction of phase trajectories.**7 Hours**

UNIT - 8

Liapunov stability criteria, Liapunov functions, direct method of Liapunov & the linear system, Hurwitz criterion & Liapunov's direct method, construction of Liapunov functions for nonlinear system by Krasvskii's method. **6 Hours**

TEXT BOOKS:

1. **Digital control & state variable methods,** M. Gopal , 3rd Edition, TMH ,2008
2. **Control system Engineering,** I. J. Nagarath & M. Gopal, New Age International (P) Ltd, 3rd edition.

REFERENCE BOOKS:

1. **State Space Analysis of Control Systems,** Katsuhiko Ogata -PHI
2. **Automatic Control Systems,** Benjamin C. Kuo & Farid Golnaraghi, 8th edition, John Wiley & Sons 2009.
3. **Modern Control Engineering,** Katsuhiko Ogata, PHI,5th Edition, 2010
4. **Modern Control Engineering,** D. Roy Choudary,PHI, 4th Reprint,2009.
5. **Modern control systems**, Dorf & Bishop- Pearson education, 11th Edition 2008

10EE56 LINEAR IC'S AND APPLICATIONS

Subject Code	:	10EE56	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

OP-AMPS AS AC AMPLIFIER: Capacitor coupled voltage follower, high Z_{in} capacitor coupled voltage follower, capacitor coupled non-inverting amplifier, high Z_{in} capacitor coupled non-inverting amplifier, capacitor coupled inverting amplifier, setting upper cut off frequency, capacitor coupled difference amplifier, and use of single polarity supply.**6 Hours**

UNIT 2

OP-AMPS FREQUENCY RESPONSE AND COMPENSATION: Op amp circuits stability, frequency and phase response, frequency compensating methods ,manufacturer's recommended compensation, op-amp circuit band width, slew rate effects,stray capacitance effects, load capacitance effects, Z_{in} mode compensation, circuit stability precautions.**7 Hours**

UNIT - 3

SIGNAL PROCESSING CIRCUITS: Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample &hold circuit. DAC and ADC (Flash and successive approximations) 7 **Hours**

UNIT - 4

OPAMPS AND NONLINEAR CIRCUITS: Op-amps in switching circuits, zero crossing detectors, inverting Schmitt trigger circuits, non-inverting Schmitt circuits, astable multivibrator, and monostable multivibrator. **6 Hours**

PART - B

UNIT - 5

SIGNAL GENERATOR: Triangular/rectangular wave generator, waveform generator design, phase shift oscillator, oscillator amplitude stabilization, Wein bridge oscillator, signal generators, output controllers **7 Hours**

UNIT - 6

ACTIVE FILTERS: First and second order high pass and low pass filters, band pass filter, band stop filter. **7 Hours**

UNIT - 7

SPECIALIZED IC APPLICATIONS: Universal active filter, switched capacitor filter, phase locked loops, power amplifiers. **6 Hours**

UNIT - 8

DC VOLTAGE REGULATORS: Voltage regulators basics, voltage follower regulator, adjustable output regulator, precision voltage regulators, and integrated circuit voltage regulators. **6 Hours**

TEXT BOOKS:

1. **Operational amplifiers and linear IC's,** David A Bell, Oxford University Press, 2010.
2. **Operational amplifiers and linear IC's,** Ramakanth A Gayakwad, PHI, 4th edition,2009.
3. **Linear integrated circuits,**S.P.Bali,TMH,2009**.**

REFERENCE BOOKS:

1. **Op Amps and Linear Integrated Circuits-Concepts and Applications,** James M.Fiore,Cengage Learing,2009.
2. O**p Amps, Design, Applications and Trouble Shooting**,Elsevier,2nd Edition.
3. **Operational amplifiers and linear IC's,** Stanley William D, **-** 4th edition, Pearson Education**.**
4. **Linear Integrated Circuits- Analysis,Design and Applications,**B.Somanathan Nair, Wiley India, First,Edition, 2009.

10EEL57 MEASUREMENTS AND CIRCUIT SIMULATION LABORATORY

Subject Code	:	**10EEL57**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurement of cable insulation and earth resistance using Meggar
3. Measurement of inductance using Maxwell Inductance-Capacitance bridge & determination of Q-factor
4. Measurement of capacitance using De-Sauty's bridge & determination of dissipation factor.
5. M easurement of active and reactive power in balanced 3-phase circuit using two-watt meter method.
6. Adjustment & calibration of 1-phase energy meter
7. Determination of ratio & phase angle error in CT.
8. a) Inverting, non-inverting & scale changing of signals using op -amps
   b) RC phase shift oscillator using op amps (Both using simulation package)
9. RC coupled amplifier-frequency response for variation of bias & coupling using simulation package
10. Rectifier circuits-Bridge rectifier, diode clipping & clamping circuits using simulation package.
11. Schmitt –trigger- inverting and non-inverting.

12 Signal generator- triangular, saw tooth and rectangular wave generation

Note: All experiments, except 5,6 and 7, are to be carried out by using components and verify the result by using a simulation package.

10EEL58 TRANSFORMERS AND INDUCTION MACHINES LABORATORY

Subject Code	:	**10EEL58**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. (a)Predetermination of efficiency and regulation by Open Circuit and Short circuit tests on single - phase transformer.

(b)Calculation of parameters of equivalent circuit from the readings of the tests and determination of efficiency and regulation from the equivalent circuit to correlate results obtained earlier.

2 Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.

3.Parallel operation of two dissimilar (different kVA) single-phase transformers and determination of load sharing and analytical verification given the Open Circuit and Short circuit tests details.

4.Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.

5. Scott connection with balanced and unbalanced resistive loads.

6. Load test on 3-phase induction motor- and plot of Torque versus speed, output hp versus efficiency, power factor and slip.

7. Predetermination of performance of 3-phase induction Motor from the Circle diagram.

8. (a)Determination of parameters of the equivalent circuit of a 3-phase Induction Motor by conducting NO load and Blocked rotor tests.

(b)Determination of performance quantities of the induction motor from the equivalent circuit to correlate the results obtained from the load test or circle diagram.

9. Speed control of 3-phase induction motor by varying rotor resistance.
10. Load test on- induction generator.
11. Load test on single- phase induction motor.

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FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010

VI SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE61	Power System Analysis and Stability	E&EE	4	-	3	25	100	125
2	10EE62	Switchgear & Protection	E&EE	4	-	3	25	100	125
3	10EE63	Electrical Machine Design	E&EE	4	-	3	25	100	125
4	10EE64	Digital Signal Processing	E&EE	4	-	3	25	100	125
5	10EE65	CAED (Computer Aided Electrical Drawing)	E&EE	1	3	3	25	100	125
6	10EE66X	Elective-I (Group A)	E&EE	4	-	3	25	100	125
7	10EEL67	D.C. Machines and Synchronous Machines Laboratory	E&EE	-	3	3	25	50	75
8	10EEL68	Control Systems Laboratory	E&EE	-	3	3	25	50	75
Total				21	09	24	200	700	900

Elective-I (Group A)

10EE661- Operation Research
10EE662 - Advanced Power Electronics
10EE663 – Fuzzy Logic
10EE664 - Object Oriented Programming using C++
10EE665 - Embedded Systems
10EE666 – Electrical Engineering Materials.

10EE61 POWER SYSTEM ANALYSIS AND STABILITY

Subject Code	:	10EE61	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

REPRESENTATION OF POWER SYSTEM COMPONENTS: Circuit models of Transmission line, Synchronous machines, Transformers and load. Single line diagram, impedance and reactance diagrams. Per unit system, per unit impedance diagram of power system. **8 Hours**

UNIT - 2

SYMMETRICAL 3 - PHASE FAULTS: Analysis of Synchronous machines and Power system. Transients on a transmission line, Short-Circuit currents and the reactance of synchronous machines with and without load . **6 Hours**

UNIT - 3 & 4

SYMMETRICAL COMPONENTS: Introduction, analysis of unbalanced load against balanced Three-phase supply, neutral shift. Resolution of unbalanced phasors into their symmetrical components, Phase shift of symmetrical components in star-delta transformer bank, Power in terms of symmetrical components**,** Analysis of balanced and unbalanced loads against unbalanced 3 phase supply, Sequence impedances and networks of power system elements (alternator, transformer and transmission line) Sequence networks of power systems. Measurement of sequence impedance of synchronous generator.

12 Hours

Part - B

UNIT - 5 & 6

UNSYMMETRICAL FAULTS: L-G, L-L, L-L-G faults on an unbalanced alternator with and without fault impedance. Unsymmetrical faults on a power system with and without fault impedance. Open conductor faults in power system. **14 Hours**

UNIT - 7

STABILITY STUDIES: Introduction**,** Steady state and transient stability. Rotor dynamics and the swing equation. Equal area criterion for transient stability evaluation and its applications. **8 Hours**

UNIT – 8

UNBALANCED OPERATION OF THREE PHASE INDUCTION MOTRORS: Analysis of three phase induction motor with one line open., Analysis of three phase induction motor with unbalanced voltage. **4 Hours**

TEXT BOOKS:

1. **Elements of Power System Analysis**, W.D.Stevenson, TMH,4th Edition
2. **Modern Power System Analysis**,.I. J. Nagrath and D.P.Kothari- TMH, 3rd Edition,2003.
3. **Symmetrical Components and Short Circuit Studies,** Dr.P.N.Reddy, Khanna Publishers

REFERENCE BOOKS:

1. **Power System Analysis**, Hadi Sadat, TMH,2nd Edition.
2. **Power system Analysis**, R.Bergen, and Vijay Vittal, Pearson publications, 2nd edition, 2006.
3. **Computer Aided Power system analysis**, G.L., Kusic, PHI.Indian Edition, 2010 .
4. **Power System Analysis**,W.D.Stevenson & Grainger,TMH, First Edition, 2003.

10EE62 SWITCHGEAR & PROTECTION

Subject Code	:	10EE62	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

SWITCHES AND FUSES: Introduction, energy management of power system, definition of switchgear, switches - isolating, load breaking and earthing. Introduction to fuse**,** fuse law, cut -off characteristics,: Time current characteristics, fuse material, HRC fuse, liquid fuse, Application of fuse

4 Hours

UNIT - 2

PRINCIPLES OF CIRCUIT BREAKERS: Introduction, requirement of a circuit breakers, difference between an isolator and circuit breaker, basic principle of operation of a circuit breaker, phenomena of arc, properties of arc, initiation and maintenance of arc, arc interruption theories - slepian's theory and energy balance theory**,** Restriking voltage, recovery voltage, Rate of rise of Restriking voltage, DC circuit breaking, AC circuit breaking, current chopping, capacitance switching, resistance switching, Rating of Circuit breakers.

10 Hours

UNIT - 3 & 4

CIRCUITS BREAKERS: Air Circuit breakers – Air break and Air blast Circuit breakers, oil Circuit breakers - Single break, double break, minimum OCB, SF_6 breaker - Preparation of SF_6 gas, Puffer and non Puffer type of SF_6 breakers. Vacuum circuit breakers - principle of operation and constructional details. Advantages and disadvantages of different types of Circuit breakers, Testing of Circuit breakers, Unit testing, synthetic testing, substitution test, compensation test and capacitance test.

LIGHTNING ARRESTERS: Causes of over voltages – internal and external, lightning, working principle of different types of lightning arresters. Shield wires.

12 Hours

PART - B

UNIT - 5

PROTECTIVE RELAYING: Requirement of Protective Relaying, Zones of protection, primary and backup protection, Essential qualities of Protective Relaying, Classification of Protective Relays

4 Hours

UNIT - 6

INDUCTION TYPE RELAY: Non-directional and directional over current relays, IDMT and Directional characteristics. Differential relay – Principle of operation, percentage differential relay, bias characteristics, distance relay – Three stepped distance protection, Impedance relay, Reactance relay, Mho relay, Buchholz relay, Negative Sequence relay, Microprocessor based over current relay – block diagram approach.

10 Hours

UNIT - 7 & 8

PROTECTION SCHEMES: Generator Protection - Merz price protection, prime mover faults, stator and rotor faults, protection against abnormal conditions – unbalanced loading, loss of excitation, over speeding. Transformer Protection - Differential protection, differential relay with harmonic restraint, Inter turn faults Induction motor protection - protection against electrical faults such as phase fault, ground fault, and abnormal operating conditions such as single phasing, phase reversal, over load. **12 Hours**

TEXT BOOKS: ,

1. **Switchgear & Protection** Sunil S.Rao,,Khanna Publishers,13th Edition,2008.
2. **Power System Protection & Switchgear,** Badriram & Viswa Kharma ,TMH,1st edition, 2001.
3. **Fundamentals of Power System protection,** Y G. Painthankar and S R Bhide,PHI, 2009.

REFERENCE BOOKS:

1. **A Course in Electrical Power,** Soni, Gupta & Bhatnagar, Dhanapatirai.
2. **Power System Protection & Switchgear,** Ravindarnath & Chandra -New age Publications.
3 **Electrical Power,** Dr S. L. Uppal, Khanna Publishers.
4. **Handbook of Switchgears**, BHEL,TMH, 5th reprint,2008.

10EE63 ELECTRICAL MACHINE DESIGN

Subject Code	:	**10EE63**	**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

PRINCIPLES OF ELECTRICAL MACHINE DESIGN: Introduction, considerations for the design of electrical machines, limitations. Different types of materials and insulators used in electrical machines.

4 Hours

UNIT - 2

DESIGN OF DC MACHINES: Output equation, choice of specific loadings and choice of number of poles, design of Main dimensions of the DC machines, Design of armature slot dimensions, commutator and brushes, magnetic circuit - estimation of ampere turns, design of yoke and poles- main and inter poles, field windings – shunt, series and inter poles. **10 Hours**

UNIT - 3 & 4

DESIGN OF TRANSFORMERS (Single phase and three phase): Output equation for single phase and three phase transformers, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and conductor cross sectional area of Primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation. Design of tank and cooling tubes (round and rectangular) **12 Hours**

PART - B

UNIT - 5 & 6

DESIGN OF INDUCTION MOTORS: Output equation, Choice of specific loadings, main dimensions of three phase induction motor, Stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of Rotor bars and end ring, design of Slip ring induction motor, estimation of No load current and leakage reactance, and circle diagram. 1**4 Hours**

UNIT - 7 & 8

DESIGN OF SYNCHRONOUS MACHINES: Output equation, Choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non

salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non-salient pole machine . **12 Hours**

TEXT BOOKS:

1. **A Course In Electrical Machine Design**, A.K.Sawhney,Dhanpatt Rai & Sons
2. **Design Of Electrical Machines**, V. N. Mittle, 4th edition

REFERENCE BOOKS:

1. **Performance And Design Of AC Machine**s, M.G.Say,CBS Publishers and Distributors Pvt.Ltd.
2. **Design Data Handbook,** A.Shanmugasundarm, G,Gangadharan,R.Palani,Wiley Eastern Ltd.

10EE64 DIGITAL SIGNAL PROCESSING

Subject Code	:	**10EE64**	**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 and 2

Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry etc, circular convolution – periodic convolution, use of tabular arrays, circular arrays, stock hams's method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods**.**

14 Hours

UNIT – 3 and 4

FAST FOURIER TRANSFORMS ALGORITHMS: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, algorithm, inverse decimation in time and inverse decimation in frequency algorithms, decomposition for a composite number N=9. **12 Hours**

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PART - B

UNIT – 5 AND 6

DESIGN OF IIR DIGITAL FILTERS: Introduction, impulse invariant & bilinear transformations, all pole analog filters- Butterworth & chebyshev, design of digital Butterworth & chebyshev, frequency transformations **12 Hours**

UNIT 7

DESIGN OF FIR DIGITAL FILTERS: Introduction, windowing, rectangular, modified rectangular, Hamming, Hanning, blackman window(excluding Kaiser window), frequency sampling techniques.

`8 Hours

UNIT - 8

REALIZATION OF DIGITAL SYSTEMS: Introduction, block diagrams and SFGs, realization of IIR systems- direct form, cascaded, parallel form, ladder structures for equal degree polynomial, realization of FIR systems – direct form, cascade form, linear phase realization. **06 Hours**

TEXT BOOKS:

1. **Digital Signal Processing Principle, Algorithm & application**, Proakis, Pearson,4th education, 2009.

2. **Digital Signal Processing ,** Sanjeet. K. Mitra ,TMH,3rd Edition,2009.

REFERENCE BOOKS:

1. **Introduction To Digital Signal Processing**, Johnny R. Johnson,PHI,2009
2. **Discrete Time Signal Processing** ,Openheim, pearson 2nd Edition 2009
3. **Digital Signal Processing,** S.Salivahanan,A. Vallaraj,C.Gnanapriya,TMH,2nd Edition,2010.
4. **Digital Signal Processing**, Ifeachor Emmauel- Pearson education,2nd Edition,2006.
5. **Fundamentals of Digital Signal Processing,**Ludeman,John Wiley, 3rd Edition,2008

10EE65 CAED (COMPUTER AIDED ELECTRICAL DRAWING)

Subject Code	:	**10EE65**	**IA Marks**	:	25
No. of Lecture and Practice Hrs./ Week	:	01Hour Lecture + 03 Hours Practical	Exam Hours	:	03
Total No. of Lecture and Practice Hrs.	:	52	Exam Marks	:	100

PART - A

1. Winding Diagrams

(a) Developed winding diagrams of D.C. machines – Simplex and multiplex double layer Lap and Wave windings.

(b) Developed winding diagrams of A.C. machines

(i) Integral and Fractional slot double layer Lap and Wave windings.

(ii) Single layer windings – Un-bifurcated 2 and 3 tier windings, mush windings, Bifurcated 2 and 3 tier windings.

2. Single line diagrams of generating stations and substations. **20 Hours**

PART - B

3. Electrical machine assembly drawing using designs data or sketches or both.

(a) Transformers - sectional views of single and three phase core and shell type transformers.

(b) D.C. machine - sectional views of yoke, field system, armature and commutator dealt Separately.

(c) Alternator – sectional views of stator and rotor dealt separately. **32 Hours**

TEXT BOOKS:

1.**Performance & Design of Alternating Current machines**, M. G. Say, CBS publishers,3rd Edition,2002.

2.**The Performance & Design of DC machines** A.E Clayton & N.N.Hancock CBS Publication,3rd Edition,2004.

REFERENCE BOOKS:

1**. Manuals of Auto - CAD**

Elective-I (Group A)

10EE661 OPERATION RESEARCH

Subject Code	:	10EE661	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
Linear Programming, Introduction, formulation of linear programming problem, Standard and matrix from, graphical solution, simplex method, computational procedure, Big-M method, Two-phase simplex method. **8 Hours**

Unit – 2
Special cases, Degeneracy, alternative optimal solutions, unbounded solutions, Non-existing optimal solutions. Duality in LPP, primal-dual relation, Formulation of dual problem, primal-dual optimal solution, limitations of LPP. 8 **Hours**

Unit – 3
ADVANCED LINEAR PROGRAMMING: Revised simplex method,dual simplex method,parametric programming. **5 Hours**

Unit – 4
Assignment problems, Introduction, Formulation, Hungarian method of solving assignment problem, special cases, Traveling salesman problem. **5 Hours**

PART – B

Unit – 5
TRANSPORTATION PROBLEMS: Basic feasible solution by different methods, fixing optimal solutions-stepping stone methode, MODI method, degenerasity. **7 Hours**
Unit – 6
GAMES THEORY: Introduction to optimal strategies, solution of 2 x 2, 2 x n, m x 2 games. Concept of dominance, Graphical method of solving. Sequencing problems, n-jobs and one machine. Heuristic problem solving (Continued) n-jobs and two machines, n-jobs and three machines, two jobs and m machines. N-jobs and m-machines. **7 Hours**

Unit – 7
PERT-CPM TECHNICS: Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic modes, prediction of date of completion, crashing of a simple networks, resource leveling by network techniques. 6 **Hours**

Unit – 8: Replacement theory, Introduction, Economic life of equipments, Replacement considering both the cases with and without tie value of money, group replacement policy. **6 Hours**

TEXT BOOK:

1.**Fundamentals of operations research** – Ackoff, R.L. and Sasieni, M.W. Wiley eastern limited, New Delhi.
2.**Opretions Research Applications and Algorithms,** Wayne L. Winston,Cengage Learning,4th Edition,2009.
3.**Operations Research** – Bronson, R- Schaum's outline series, Mc Graw Hill International, 2nd Edition.
4.**Introduction to operations Research**,Gillet, B.e., TMH,1979.
5. **Introduction to operations Research** – Hillier, F.S. and Lieberman, G.J, TMH, 8th Edition, 2009

6. **Operational Research,** S.D sharma

10EE662 ADVANCED POWER ELECTRONICS

Subject Code	:	**10EE662**	**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
DC-DC SWITCHED MODE CONVERTERS: Topologies, Buck, boost, buck-boost, and Cuk converters, Full Bridge DC-DC converter-detailed theory, working principles, modes of operation, with detailed circuits and wave forms, applications, merits and demerits. **16 Hours**

UNIT - 3 & 4
DC-AC SWITCHED MODE INVERTERS: Single-phase inverters, three phase inverters. SPWM inverter, detailed theory, working principles, modes of operation with circuit analysis, applications, merits and demerits, problems based on input output voltage relationship.

10 Hours

PART - B

UNIT - 5
RESONANT CONVERTERS: Zero voltage and zero current switching, resonant switch converters, and comparison with hard switching, switching locus diagrams, and working principle. **8 Hours**

UNIT - 6
HIGH FREQUENCY INDUCTOR AND TRANSFORMERS: Design principles, definitions, comparison with conventional design and problems. Design of Flyback transformer. **08 Hours**

UNIT - 7 & 8

POWER SUPPLIES: Introduction, DC power supplies: fly back converter, forward converter, push-pull converter, half bridge converter, full bridge converter, AC power supplies: switched mode ac power supplies, resonant ac power supplies, bidirectional ac power supplies. **10 Hours**

TEXT BOOKS:

1. **Power Electronics,** Daniel.W.Hart, TMH, First Edition,2010.
2. **Power Electronics - converters, application & design**, Mohan N, Undeland T.M., Robins, W.P,John Wiley ,3rd Edition 2008
3. **Power Electronics-Circuits, Devices, Applications,** Rashid M.H., PHI, 3rd Edition, 2008.

REFERANCE BOOKS:

1.Power Electronics Essentials and Applications,L.Umanand, Wiely India Pvt Ltd,Reprint,2010
2.Modern Power Electronics and A.C. Drives, Bose B.K, PHI, 2009.
3. Digital Power Electronics And Applications, Muhammad Rashid, Elsevier , first edition, 2005.
4. **Power Electronics,Devices,Circuits and Industrial Applications**,V.R.Moorthi,Oxford,7th impression,2009.

10EE663 FUZZY LOGIC

Subject Code	:	**10EE663**	**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
THE MATHEMATICS OF FUZZY CONTROL: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle. **8 Hours**

UNIT - 2, 3 and 4
THEORY OF APPROXIMATE REASONING: Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference.
NON-LINEAR FUZZY CONTROL: FKBC as a linear transient element, PID like FKBC, sliding mode FKBC, Sugeno FKBC. **18 Hours**

PART - B

UNIT - 5 and 6
FUZZY KNOWLEDGE BASED CONTROLLERS (FKBC): Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures. Simple applications of FKBC (washing machines, traffic regulations, lift control, aircraft landing Control etc).
14 Hours

UNIT - 7 and 8
ADAPTIVE FUZZY CONTROL: Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller. **12 Hours**

TEXT BOOKS:

1. **Fuzzy Logic With Engineering Applications-** Timoty Ross,John Wiley, Second Edition, 2009.
2. **Fuzzy Sets Uncertainty and Information**- G. J. Klir and T. A. Folger, PHI IEEE, 2009.

REFERENCE BOOKS:

1. **An Introduction to Fuzzy Control**, D. Diankar, H. Hellendoom and M. Reinfrank ,Narosa Publishers India, 1996.
2. **Essentials of Fuzzy Modeling and Control**, R. R. Yaser and D. P. Filer,John Wiley, 2007.
3. **Fuzzy Logic Intelligence Control And Information,** Yen- Pearson education,First Edition,2006.

10EE664 OBJECT ORIENTED PROGRAMMING USING C ++

Subject Code	:	10EE664	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

PRINCIPLES OF OBJECT-ORIENTED PROGRAMMING: Review of Procedure Oriented Programming, Basic concepts of Object Oriented Programming – Object, Class, Encapsulation, Inheritance, Polymorphism; Benefits of OOPs, Applications of OOP's. **4 Hours**

UNIT - 2

THE BASIC LANGUAGE C++: A comparison of C and C++, Structure of C++ program with Class, Preprocessor directives, C++ Statements – Input/Output, Comments, Tokens, Keywords, Identifiers, Constants, Data types – string, pointer, reference, boole, enumeration, array, complex number; typedef names, type compatibility, type conversion, qualifier – const, volatile; Operators in C++, Operator Precedence and Operator Overloading; C++ expressions – New and Delete. **6 Hours**

UNIT - 3

FUNCTIONS IN C++: Introduction, The main() function, Function prototype, Call by reference, Return by reference, Inline functions, Default arguments, const Arguments, Function Overloading, Friend and Virtual functions, pointer to functions. **8 hours**

UNIT - 4

CLASSES AND OBJECTS: Introduction – declaration and definition of a Class, defining member functions, C++ program with a Class, Making an outside function Inline, Nesting of member functions, Arrays within a class, Static data members, static member functions, Objects – global & local objects, scope & lifetime, memory allocation for objects, dynamically allocated objects, pointers to objects, arrays of objects, function arguments with objects, returning objects; const member functions. **8 Hours**

PART - B

UNIT - 5

CONSTRUCTORS AND DESTRUCTORS: Introduction, Constructors, Parameterized Constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Constructing two-dimensional arrays, const Objects, Destructors. **4 Hours**

UNIT - 6

OPERATOR OVERLOADING AND TYPE CONVERSION: Introduction, Defining operator overloading, Overloading unary operators, Overloading binary operators, Overloading binary operators using Friends, Rules for overloading operators, overloading a comma operator, overloading the output operator , Type conversion. **7 Hours**

UNIT - 7

INHERITANCE: Introduction, Defining derived classes, Single inheritance, Making a private member Inheritable, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Constructors & Destructors in base & derived classes. **6 Hours**

UNIT - 8

POINTER, VIRTUAL FUNCTIONS AND POLYMORPHISM: Introduction, Pointers, Pointers to Objects, this pointer, Pointers to derived classes, type-checking pointers, pointers to members, Virtual functions, Pure virtual functions.

MANAGING CONSOLE I/O AND FILE I/O: C++ streams, C++ stream classes, examples of formatted and unformatted I/O operations, Classes for file stream operations, Methods of Opening and Closing a File, Examples of Opening file using constructor open(), file modes (simple programming exercises). **9 Hours**

TEXT BOOKS:

1. **Object Oriented Programming with C++**- Balagurusamy, E, TMH,4th edition, 2008.
2. **C++, The Complete Reference -**Herbert Schildt**,** , TMH, 4th edition
3. **Object Oriented Programming with C++**, Farrell,Cengage Learning,First Edition,2008.

REFERENCE BOOKS:

1. **The C++ programming language,**Bjarne Stroustrup, Pearson Education, 3rd edition,2006.
2. **Objected oriented programming with C++,**Bhave, Pearson Education, First Edition,2006.

10EE665 EMBEDDED SYSTEMS

Subject Code	:	**10EE665**	**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

CONCEPT OF EMBEDDED SYSTEM DESIGN: Components, classification, skills required.Embedded Micro controller cores: Architecture of 6808 and 6811.Embedded Memories ROM variants, RAM.Applications of embedded system: Examples of Embedded systems SOC for cellless bar code scanner. **10 Hours**

UNIT - 3

TECHNOLOGICAL ASPECTS OF EMBEDDED SYSTEM: Interfacing between analog and digital blocks, Signal conditioning, digital signal processing, DAC & ADC interfacing, Sample & hold, multiplexer interface Internal ADC interfacing (excluding 6805 & 6812), Data Acquisition System and Signal conditioning using DSP. **10 Hours**

UNIT - 4

DESIGN TRADE OFFS DUE TO PROCESS INCOMPATIBILITY, THERMAL CONSIDERATIONS: Issues in embedded system design. Design challenge, design technology, trade offs. Thermal considerations. **6Hours**

PART - B

UNIT - 5 & 6

Software aspects of Embedded Systems, real time programming Languages, operating systems. Programming concepts and embedded programming in C.Round Robin, Round Robin with interrupts, function queue-scheduling architecture, Real time OS architecture, selecting architecture. Introduction to RTOS. **12 Hours**

UNIT - 7 & 8

Subsystem interfacing with external systems user interfacing, Serial I/O devices, Parallel port interfaces: Input switches, Key boards and Memory interfacing.

Case study: Embedded velocity PID controller, PI controller with a PWM actuator. **14Hours**

TEXT BOOKS:

1. **Embedded Microcomputer systems: Real time interfacing-** Valvano, J.W, Cengage Learning,2nd Edition 5th Indian reprint,2009
2. **The Art of Designing Embedded systems**- Ganssle, Jack, Newness

3. **Embedded System, Architecture, Programming and Design-** Raj Kamal ,TMH,2nd Edition 2008.

REFERENCE BOOKS:

1. **A Unified Hardware/Software Introduction-**Frank Vahid/Tony Givargis, Wiley student edition 2002
2. **Motorola and Intel Manuals**
3. **Embeded Software Premier,** Simon David, Addison Wessly 2000.

10EE666 ELECTRICAL ENGINEERING MATERIALS

Subject Code	:	**10EE666**	**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

CONDUCTING MATERIALS: Review of metallic conduction on the basis of free electron theory. Fermi-Dirac distribution – variation of conductivity with temperature and composition, materials for electric resistors- general electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder. **6 Hours**

UNIT - 2

SEMICONDUCTORS: Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Magnetic materials: Classification of magnetic materials- origin of permanent magnetic dipoles, ferromagnetism, hard and soft magnetic materials, magneto materials used in electrical machines, instruments and relays. **10 Hours**

UNIT - 3 & 4

DIELECTRICS: Dielectric, polarization under static fields- electronic ionic and dipolar polarizations, behavior of dielectrics in alternating fields, Factors influencing dielectric strength and capacitor materials. Insulating materials, complex dielectric constant, dipolar relaxation and dielectric loss.

INSULATING MATERIALS: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators. **10 Hours**

PART - B

UNIT - 5

MATERIALS FOR SPECIAL APPLICATIONS: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts. **6 Hours**

UNIT - 6

MODERN TECHNIQUES FOR MATERIALS STUDIES: Optical microscopy, Electron microscopy, Photo electron spectroscopy, Atomic absorption spectroscopy, magnetic resonance, nuclear magnetic resonance, electron spin resonance and ferromagnetic resonance. **6 Hours**

UNIT - 7

Introduction Properties and Application of Piezoelectric materials, Eletrostrictive materials, Ferromagnetic materials, Magnetostrictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels. **6 Hours**

UNIT - 8

Ceramics: properties, application to conductors, insulators & capacitors
Plastics: Thermoplastics, rubber, thermostats, properties.

8Hours

TEXT BOOKS:

1.An Introduction to Electrical Engineering- Indulkar C.S. & Thiruvengadam. S,Chand publishers.
2.Materials Science for Electrical and Electronic Engineers, Ian P**.** Jones, Oxford University Press,Indian Edition, 2007.
3.Electrical Engineering Materials,Kapoor P L., Khanna Publications.
4.Renewable Energy Sources and Emerging Technologies, D.P. Kothari, K.C. Singal, Rakesh Ranjan. PHI, 2008.

REFERENCES:

1.Electrical Properties of Materials, L.Solymar, D.Walsh, 8th Indian Edition- Oxford University Press Seventh Edition.
2.MEMS and MOEMS Technology and Applications, P.Rai-Choudhury (Editor), PHI,2009 .
3. Introduction to Electronic Properties and Materials,David Jiles,CRC Press,2nd Ediyion.

10EEL 67 DC MACHINES AND SYNCHRONOUS MACHINES LABORATORY

Subject Code	:	**10EEL67**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Load characteristics of a D.C. shunt and compound generator - i) Short shunt-Cumulative and Differential (ii) Long shunt-Cumulative and Differential.
2. Load test on a DC motor- determination of speed-torque and HP-efficiency characteristics.
3. Swinburne's Test.
4. Hopkinson's Test.
5. Field's test on series motors.
6. Retardation test- electrical braking method.
7. Speed control of DC motor by armature voltage control and flux control.
8. Ward Leonard method of speed control of D.C. motor.
9. Voltage regulation of an alternator by EMF and MMF method.
10. Voltage regulation of an alternator by ZPF method.
11. Slip test and determination of regulation.
12. Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.
13. V and Inverted V curves of a synchronous motor.
14. Measurement of X_1, X_2 and X_o of a Synchronous generator and calculation of currents for an LG,LL or LLG fault.

10EEL68 CONTROL SYSTEMS LABORATORY

Subject Code	:	**10EEL68**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Using MATLAB/SCILAB a) Simulation of a typical second order system and determination of step response and evaluation of time- domain specifications

b) Evaluation of the effect of additional poles and zeroes on time response of second order system
c) Evaluation of effect of pole location on stability
d) Effect of loop gain of a negative feedback system on stability

2. (a) To design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequency response.
   (b) To determine experimentally the transfer function of the lead compensating network.
3. (a) To design RC lag compensating network for the given specifications., viz., the maximum phase lag and the frequency at which it occurs, and to obtain its frequency response.
   (b) To determine experimentally the transfer function of the lag compensating network.
4. Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
5. To study the effect of P, PI, PD and PID controller on the step response of a feedback control system (using control engineering trainer/process control simulator). Verify the same by simulation.
6. a) Experiment to draw the speed – torque characteristic of a two - phase A.C. servomotor.
   b) Experiment to draw speed torque characteristic of a D.C. servomotor.
7. To determine experimentally the frequency response of a second -order system and evaluation of frequency domain specifications.

8. Using MATLAB/SCILAB

   a) Simulate a D. C. position control system and obtain its step response

   b) To verify the effect of the input wave form, loop gain system type on steady state errors.

   c) To perform a trade-off study for lead compensation

   d) To design a PI controller and study its effect on steady state error

9. Using MATLAB/SCILAB

   a) To examine the relationships between open-loop frequency response and stability , open loop frequency and closed loop transient response
   b) To study the effect of addition closed loop poles and zeroes on the closed loop transient response

10. Using MATLAB/SCILAB

    a) Effect of open loop and zeroes on root locus contour
    b) To estimate the effect of open loop gain on the transient response of closed loop system by using Root locus
    c) Comparative study of Bode, Nyquist and Root locus with respect to Stability.

11. Experiment to draw to syncro pair characteristics.

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FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010

VII SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE71	Computer Techniques in Power System Analysis	E&EE	4	-	3	25	100	125
2	10EE72	Electrical Power Utilization	E&EE	4	-	3	25	100	125
3	10EE73	High Voltage Engineering	E&EE	4	-	3	25	100	125
4	10EE74	Industrial Drives and Applications	E&EE	4	-	3	25	100	125
5	10EE75X	Elective-II (Group B)	E&EE	4	-	3	25	100	125
6	10EE76X	Elective-III (Group C)	E&EE	4	-	3	25	100	125
7	10EEL77	Relay and High Voltage Laboratory	E&EE	-	3	3	25	50	75
8	10EEL78	Power System Simulation Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

Elective-II (Group B)
10EE751 - HVDC Transmission
10EE752 - Programmable Logic Controllers
10EE753 - Artificial Neural Network
10EE754 - Operating System
10EE755 - Digital System with VHDL
10EE756 -Testing and Commissioning of Electrical Equipment

Elective-III (Group C)
10EE761 - Power System Planning
10EE762 - Computer Control of Electrical Drives
10EE763 - Data Structure
10EE764 - VLSI Circuits and Design
10EE765 - Micro & Smart System Technology
10EE766 - Electromagnetic Compatibility

10EE71 COMPUTER TECHNIQUES IN POWER SYSTEM ANALYSIS

Subject Code	:	**10EE71**	**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

NETWORK TOPOLOGY: Introduction, Elementary graph theory – oriented graph, tree, co-tree, basic cut-sets, basic loops; Incidence matrices – Element-node, Bus incidence, Tree-branch path, Basic cut-set, Augmented cut-set, Basic loop and Augmented loop, Primitive network – impedance form and admittance form. **6 Hours**

UNIT - 2

NETWORK MATRICES: Introduction, Formation of Y_{BUS} by method of inspection (including transformer off-nominal tap setting) and method of singular transformation ($Y_{BUS} = A^T yA$), Formation of Bus Impedance matrix by step by step building algorithm (without mutual coupling elements). **6 Hours**

UNIT - 3 & 4

LOAD FLOW STUDIES: Introduction, Power flow equations, Classification of buses, Operating constraints, Data for load flow, Gauss-Seidal Method – Algorithm and flow chart for PQ and PV buses (numerical problem for one iteration only), Acceleration of convergence; Newton Raphson's Method – Algorithm and flow chart for NR method in polar coordinates (numerical problem for one iteration only). Algorithm for Fast Decoupled load flow method, Comparison of Load Flow Methods. **14 Hours**

PART - B

UNIT - 5 & 6

ECONOMIC OPERATION OF POWER SYSTEM: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation scheduling including generator limits and neglecting losses; Iterative techniques; Economic Dispatch including transmission losses – approximate penalty factor, iterative technique for solution of economic dispatch with losses; Derivation of transmission loss formula; Optimal scheduling for Hydrothermal plants – problem formulation, solution procedure and algorithm. **12 Hours**

UNIT - 7 & 8

TRANSIENT STABILITY STUDIES: Numerical solution of Swing Equation – Point-by-point method, Modified Euler's method, Runge-Kutta method, Milne's predictor corrector method. Representation of power system for transient stability studies – load representation, network performance equations. Solution techniques with flow charts. **14 Hours**

TEXT BOOKS:

1. **Computer Methods in Power System Analysis,** Stag, G. W., and EI-Abiad, A. H.- McGraw Hill International Student Edition. 1968
2. **Computer Techniques in Power System Analysis**, Pai, M. A- TMH, 2nd edition, 2006.

REFERENCE BOOKS:

1. **Modern Power System Analysis,** Nagrath, I. J., and Kothari, D. P, TMH,3rd Edition, 2003.
2. **Advanced Power System Analysis and Dynamics**, Singh, L. P, New Age International (P) Ltd, New Delhi, 2001.
3. **Computer Aided Power System Operations and Analysis**"- Dhar, R. N, TMH, 1984.
4. **Power System Analysis,** Haadi Sadat, TMH, 2nd Edition, 12th reprint, 2007

10EE72 ELECTRICAL POWER UTILIZATION

Subject Code	:	**10EE72**	**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

HEATING AND WELDING: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building. Electric welding, resistance and arc welding, control devices and welding equipment. **10 Hours**

UNIT - 2

ELECTROLYTIC PROCESS: Fundamental principles, extraction, refining of metals and electroplating. Factors affecting electro deposition process, power supply for electrolytic process. **6 Hours**

UNIT - 3 & 4

ILLUMINATION: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, vapor, CFL and LED lamps and their working, comparision, Glare and its remedy. **10 Hours**

PART - B

UNIT - 5, 6 & 7

ELECTRIC TRACTION: Introduction, requirements of an ideal traction,systems of traction, speed time curve, tractive effort,co-efficient of adhesion, selection of traction motors, method of speed control, energy saving by series parallel control, ac traction equipment. AC series motor, characteristics, regenerative braking, linear induction motor and their use. AC traction, diesel electric equipment, trains lighting system, specific energy, factors affecting specific energy consumption. **20 Hours**

UNIT - 8

INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES: Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption. **6 Hours**

TEXT BOOKS:

1. **Utilization Of Electric Energy,**E Openshaw Taylor, 12th Impression,2009,Universities Press.
2. **Modern Electric, Hybrid Electric and Fuel Cell Vehicles**, Mehrdad, Ehsani, Yimin Gao, Sabastien. E. Gay, Ali Emadi- CRC Press.

REFERENCE BOOKS:

1. **A Course in Electrical Power**, Soni Gupta and Bhatnager-Dhanapat Rai & sons.
3. **Electrical Power,** Dr. S.L.Uppal, Khanna Publications

10EE73 HIGH VOLTAGE ENGINEERING

Subject Code	:	10EE73	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: Introduction to HV technology, need for generating high voltages in laboratory. Industrial applications of high voltage, Electrostatic precipitation, separation, painting and printing.

6Hours

UNIT - 2 & 3

BREAKDOWN PHENOMENA: Classification of HV insulating media. Properties of important HV insulating media under each category. Gaseous dielectrics,Ionization: primary and secondary ionization processes. Criteria for gaseous insulation breakdown based on Townsend's theory. Limitations of Townsend's theory. Streamer's theory breakdown in non uniform fields. Corona discharges. Breakdown in electro negative gases. Paschen's law and its significance. Time lags of Breakdown. Breakdown in solid dielectrics: Intrinsic Breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown. Breakdown of liquid dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown. **12 Hours**

UNIT - 4

GENERATION OF HV AC AND DC VOLTAGE: HV AC-HV transformer; Need for cascade connection and working of transformers units connected in cascade. Series resonant circuit- principle of operation and advantages. Tesla coil. HV DC- voltage doubler circuit, cock croft- Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop. **8 Hours**

Part - B

UNIT - 5

GENERATION OF IMPULSE VOLTAGE AND CURRENT: Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage. Multistage impulse generator working of Marx impulse. Rating of impulse generator. Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Trigatron gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse current. **6 Hours**

UNIT - 6

MEASUREMENT OF HIGH VOLTAGES: Electrostatic voltmeter-principle, construction and limitation. Chubb and Fortescue method for HV AC measurement. Generating voltmeter- Principle, construction. Series resistance micro ammeter for HV DC measurements. Standard sphere gap measurements of HV AC, HV DC, and impulse voltages; Factors affecting the measurements. Potential dividers-resistance dividers capacitance dividers mixed RC potential dividers. Measurement of high impulse currents-Rogogowsky coil and Magnetic Links. **10 Hours**

UNIT - 7

NON-DESTRUCTIVE INSULATION TESTING TECHNIQUES: Dielectric loss and loss angle measurements using Schering Bridge, Transformer ratio Arms Bridge. Need for discharge detection and PD measurements aspects. Factor affecting the discharge detection. Discharge detection methods-straight and balanced methods. **6 Hours**

UNIT - 8

HIGH VOLTAGE TESTS ON ELECTRICAL APPARATUS: Definitions of terminologies, tests on isolators, circuit breakers, cables insulators and transformers. **4 Hours**

TEXT BOOKS:

1. **High Voltage Engineering**, M.S.Naidu and Kamaraju- 4th Edition, THM, 2008.
2. **High Voltage Engineering Fundamentals**, E.Kuffel and W.S. Zaengl, 2nd Edition, Elsevier Press, 2005.
3. **High Voltage Engineering** ,C.L.Wadhwa, New Age International Private limited, 1995.

REFERENCE BOOKS:

1.**High Voltage Engineering Theory and Practice,** Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, 2nd Edn(Revised & Expanded) Marcel-Dekker Publishers(Special Indian Edn.).

10EE74 INDUSTRIAL DRIVES & APPLICATIONS

Subject Code	:	**10EE74**	**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

AN INTRODUCTION TO ELECTRICAL DRIVES & ITS DYNAMICS: Electrical drives. Advantages of electrical drives. Parts of electrical drives, choice of electrical drives, status of dc and ac drives, Dynamics of electrical drives, Fundamental torque equation, speed torque conventions and multiquadrant operation. Equivalent values of drive parameters, components of low torques, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization. **9 Hours**

UNIT - 2

SELECTION OF MOTOR POWER RATING: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating. **5 Hours**

UNIT - 3 & 4

D C MOTOR DRIVES:

(a) Starting braking, transient analysis, single phase fully controlled rectifier, control of separately excited dc motor, Single-phase half controlled rectifier control of separately excited dc motor.

(b) Three phase fully controlled rectifier - control of separately excited dc motor, three phase half controlled rectifier - control of separately excited dc motor, multi-quadrant operation of separately excited dc motor fed from fully controlled rectifier. Control of dc series motor, chopper controlled dc drives-separately excited dc motor and series motor. **12 Hours**

PART - B

UNIT - 5

INDUCTION MOTOR DRIVES:

Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, starting braking, transient analysis.

06 Hours

UNIT - 6

Stator voltage control:

Variable voltage and variable frequency control, voltage source inverter control, closed loop control, current source inverter control, , rotor resistance control, slip power recovery, speed control of single phase induction motors. **06 Hours**

UNIT - 7

SYNCHRONOUS MOTOR DRIVES: Operation from fixed frequency supply, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyrister inverter. **10 Hours**

UNIT - 8

INDUSTRIAL DRIVES: Rolling mill drives, cement mill drives, paper mill drives and textile mill drives.

4 Hours

TEXT BOOK:

1. **Fundamentals of Electrical Drives**, G.K Dubey , Narosa publishing house, 2nd Edition,2002.

REFERENCE BOOKS:

1. **Electrical Drives**, N.K De and P.K. Sen- PHI, 2009.
2. **A First Course On Electric Drives**, S.K Pillai-Wiley Eastern Ltd 1990.
3. **Power Electronics, Devices, Circuits and Industrial Applications**, V.R. Moorthi, "Oxford University Press, 2005.
4. **Electric Motor Drives,Modeling,Analysis and Control**, R.Krishnan,PHI,2008.

ELECTIVES-II(GROUP **B)**

10EE751 HVDC TRANSMISSION

Subject Code	:	**10EE751**	**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

GENERAL ASPECTS OF DC TRANSMISSION AND COMPARISON OF IT WITH AC TRANSMISSION: Historical sketch, constitution of EHV AC and DC links, Limitations and Advantages of AC and DC Transmission**.** **12 Hours**

UNIT - 3 & 4

CONVERTER CIRCUITS: Valve Characteristics, Properties of converter circuits, assumptions, single phase, three phase converters, choice of best circuits for HV DC circuits. **12 Hours**

PART - B

UNIT - 5

ANALYSIS OF THE BRIDGE CONVERTER: Analysis with grid control but no over lap, Analysis with grid control and with over lap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion. **10 Hours**

UNIT - 6 & 7

CONTROL OF HVDC CONVERTERS AND SYSTEMS: grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control. **10 Hours**

UNIT - 8

PROTECTION: Introduction, DC reactor, voltage oscillations and valve dampers, current oscillations and anode dampers, DC line oscillations and line dampers, clear line faults and reenergizing the line. **8 Hours**

TEXT BOOKS:

1. **Direct current Transmission,** EW Kimbark,
2. **Power system stability and control,** Prabha Kundur, TMH, 9th reprint, 2007.
3. **High Voltage Power Transmission:The HVDC Options,** Jos Arrillaga, Y.H.Liu and Mevelle R Watson, Wiley Interscience.
4. **High Voltage D.C.Power Transmission System,** K.R.Padiyar,New Age International Publishers Ltd.

10EE752 PROGRAMMABLE LOGIC CONTROLLERS

Subject Code	:	10EE752	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

INTRODUTION: Introduction to Programmable logic controller (PLC), role in automation (SCADA), advantages and disadvantages, hardware, internal architecture, sourcing and sinking, characteristics of I/O devices, list of input and output devices, examples of applications. I/O processing, input/output units, signal conditioning, remote connections, networks, processing inputs I/O addresses. **7 Hours**

UNIT - 2

ROGRAMMING: Ladder programming- ladder diagrams, logic functions, latching, multiple outputs, entering programs, functional blocks, programme examples like location of stop and emergency switches **8 Hours**

UNIT - 3 & 4

PROGRAMMING LANGUAGES: Instruction list, sequential functions charts & structured text, jump and call subroutines**.** **10 Hours**

PART - B

UNIT - 5

INTERNAL RELAYS: ladder programmes, battery- backed relays, one - shot operation, set and reset, master control relay. **5 Hours**

UNIT - 6 & 7

Timers and counters: Types of timers, programming timers, ON and OFF- delay timers, pulse timers, forms of counter, programming, up and down counters, timers with counters, sequencer. **12 Hours**

UNIT - 8

Shift register and data handling: shift registers, ladder programs, registers and bits, data handling, arithmetic functions, temperature control and bottle packing applications. **10 Hours**

Note: Programming is to be with reference to only Mitsubhish PLC

TEXT BOOKS:

1. **Programmable Logic controllers-**W Bolton, 5th edition, Elsevier- newness, 2009.
2. **Programmable logic controllers - principles and applications"-**John W Webb, Ronald A Reis, Pearson education, 5th edition, 2nd impression, 2007.

REFERENCE BOOKS:

1. **Programmable Controller Theory and Applications**,L. A Bryan, E. A Bryan, An industrial text company publication, 2nd edition, 1997.
2. **Programmable Controllers, An Engineers Guide**-E. A Paar, newness, 3rd edition, 2003.

10EE753 ARTIFICIAL NEURAL NETWORK

Subject Code	:	10EE753	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, history, structure and function of single neuron, neural net architectures, neural learning, use of neural networks. **7 Hours**

UNIT - 2

Supervised learning, single layer networks, perceptrons, linear separability, perceptron training algorithm, guarantees of success, modifications. **6 Hours**

UNIT - 3

Multiclass networks-I, multilevel discrimination, back propagation, setting parameter values, theoretical results. **6 Hours**

UNIT - 4

Accelerating learning process, application, Madaline adaptive multilayer networks. **7 Hours**

PART - B

UNIT - 5

Prediction networks, radial basis functions, polynomial networks, regularization, unsupervised learning, winner-take-all networks. **7 Hours**

UNIT - 6

Learning vector quantizing, counter propagation networks, adaptive resonance theorem, toplogically organized networks, distance based learning, recognition. **6 Hours**

UNIT - 7

Associative models, Hop Field networks, brain state networks, Boltzmann machines, hetero associations. **7 Hours**

UNIT - 8

Optimization using Hopfiled networks, simulated annealing, random search, evolutionary computation. **6 Hours**

TEXT BOOKS:

1. **Elements Of Artificial Neural Networks** -Kishan Mehrotra, C. K. Mohan, Sanjay Ranka, Penram, 1997
2. **Artificial Neural Networks**- R, Schalkoff, McGraw Hill, 1997.

REFERENCE BOOKS:

1.Neural Network Design- Hagan, Demuth and Beale Cengage,2nd Edition

2.Introduction To Artificial Neural Systems- J. Zurada, Jaico, 2003

3.Neural Networks -Haykins, PHI, 1999.

4. Artificial Neural Networks, B. Yegnanarayana ,PHI,2009 Edition.

10EE754 OPERATING SYSTEM

Subject Code	:	10EE754	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 OPERATING SYSTEM, SYSTEM STRUCTURES: What operating system do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. **6 Hours**

UNIT - 2

Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling. **7 Hours**

UNIT - 3

PROCESS SYNCHRONIZATION: Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors. **7 Hours**

UNIT - 4

DEADLOCKS: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **6 Hours**

PART – B

UNIT - 5

MEMORY MANAGEMENT: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.**7 Hours**

UNIT - 6

FILE SYSTEM, IMPLEMENTATION OF FILE SYSTEM: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **7 Hours**

UNIT - 7

SECONDARY STORAGE STRUCTURES, PROTECTION: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems. **6 Hours**

UNIT - 8

CASE STUDY: THE LINUX OPERATING SYSTEM: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication. **6 Hours**

TEXT BOOK:

1. **Operating System Principles –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley, 8th Edition, 2009.

REFERENCE BOOKS:

1. **Operating Systems: A Concept Based Approach** – D.M Dhamdhere, TMH, 2nd Edition,2006.
2. **Operating Systems,** P.C.P. Bhatt, PHI, 2nd Edition, 2008.
3. **Operating Systems,**Harvey M Deital,Pearson Education, 3rd Edition.

10EE755 DIGITAL SYSTEM DESIGN WITH VHDL

Subject Code	:	**10EE755**	**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: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter. **10 Hours**

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PALs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. **5 Hours**

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider. **5 Hours**

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines. **6 Hours**

PART - B

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

6 Hours

UNIT - 6

FLOATING-POINT ARITHMETIC: Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations. **6 Hours**

UNIT - 7

ADDITIONAL TOPICS IN VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multivalued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and TEXTIO. **7 Hours**

UNIT - 8

VHDL MODELS FOR MEMORIES AND BUSES: Static RAM, A simplified 486 bus model, interfacing memory to a microprocessor bus. **7 Hours**

TEXT BOOKS:

1. **Digital Systems Design Using VHDL,**Charles H. Roth. Jr, Cengage, 2010.
2. **Digital Electronics And Design With VHDL,** A. Pedroni, Volnet, Elsevier, 1st edition, 2008

REFERENCE BOOKS:

1. **Fundamentals of Digital Logic with VHDL Design,**Stephen Brwon & Zvonko Vranesic, TMH,2nd Edition 2006
2. **Digital Fundamentals using VHDL,**Floyd, Pearson Education, 2003,
3. **VHDL Primer**, J. Bhaskar , PHI, 2009.

10EE756 TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT

Subject Code	:	**10EE756**	**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

TRANSFORMERS:

a. Specifications: Power and distribution transformers as per BIS standards.

b. Installation: Location, site, selection, foundation details (like bolts size, their number, etc), code of practice for terminal plates, polarity & phase sequence, oil tanks, drying of windings and general inspection.

5 Hours

c. Commissioning tests: Following tests as per national & International Standards, volt ratio test, earth resistance, oil strength, Bucholz & other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature rise test.

7 Hours

d. Specific Tests: Determination of performance curves like efficiency, regulation etc, and determination of mechanical stress under normal &abnormal conditions.

3 Hours

UNIT - 3 & 4

SYNCHRONOUS MACHINES:

a. Specifications: As per BIS standards.

b. Installation: Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out.

c. Commissioning Tests: Insulation, Resistance measurement of armature & field windings, waveform & telephone interference tests, line charging capacitance.

4 Hours

d. Performance tests: Various tests to estimate the performance of generator operations, slip test, maximum lagging current, maximum reluctance power tests, sudden short circuit tests, transient & sub transient parameters, measurements of sequence impedances, capacitive reactance, and separation of losses, temperature rise test, and retardation tests.

6 Hours

e. Factory tests: Gap length, magnetic eccentricity, balancing vibrations, bearing performance.

2 Hours

PART - B

UNIT - 5, 6 & 7
INDUCTION MOTORS:
a. **Specifications** for different types of motors, Duty, I.P. protection.

2 Hours

b. Installation: Location of the motors (including the foundation details) & its control apparatus, shaft & alignment for various coupling, fitting of pulleys & coupling, drying of windings.

4 Hours

c. Commissioning Test: Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing.

5 Hours

Electrical Tests: Insulation test, earth resistance, high voltage test, starting up, failure to speed up to take the load, type of test, routine test, factory test and site test (in accordance with ISI code

4 Hours

d. Specific Tests: Performance & temperature raise tests, stray load losses, shaft alignment, and re-rating & special duty capability.

4 Hours

UNIT - 8
SWITCH GEAR & PROTECTIVE DEVICES: Standards, types, specification, installation, commissioning tests, maintenance schedule, type & routine tests.

6 Hours

TEXT BOOKS:

1. **Testing & Commissioning Of Electrical Equipment** -S. Rao,Khanna Publishers,2004
2. **Testing & Commissioning Of Electrical Equipment** -B .V. S. Rao, Media Promoters and Publication Pvt., Ltd.

REFERENCE BOOKS:

1. **Relevant Bureau of Indian Standards**
2. **A Handbook on Operation and Maintenance of Transformers-** H. N. S. Gowda, Published by H. N. S. Gowda,2006
3. **Handbook of SwitchGears,**BHEL, TMH,2005.
4. **J and P Transformer Book**,Elsevier Publication.

ELECTIVES-II (GROUP **C)**

10EE761 POWER SYSTEMPLANNING

Subject Code	:	**10EE761**	**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 OF POWER PLANNING, National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **8 Hours**

UNIT - 2 & 3

GENERATION PLANNING, Integrated power generation, co-generation / captive power, power pooling and power trading, transmission & distribution planning, power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs.

10 Hours

UNIT - 4

COMPUTER AIDED PLANNING: Wheeling, environmental effects, green house effect, technological impacts, insulation co-ordination, reactive compensation. **8 Hours**

PART - B

UNIT - 5 & 6

POWER SUPPLY RELIABILITY, reliability planning, system operation planning, load management, load prediction, reactive power balance, online power flow studies, test estimation, computerized management. Power system simulator**.** **10 Hours**

UNIT - 7 & 8

Optimal Power system expansion planning, formulation of least cost optimization problem incorporating the capital, operating and maintenance cost of candidate plants of different types (thermal hydro nuclear non conventional etc), Optimization techniques for solution by programming. **16 Hours**

TEXT BOOK:

1. **Electrical Power System Planning,** A.S.Pabla, Macmillan India Ltd, 1998

10EE762 COMPUTER CONTROL OF ELECTRICAL DRIVES

Subject Code	:	10EE762	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

REVIEW OF MICRO CONTROLLERS IN INDUSTRIAL DRIVES SYSTEM: Typical Micro controller's 8 bit 16 bit (only block diagram) Digital Data Acquisition system, voltage sensors, current sensors, frequency sensors and speed sensors. **4 Hours**

UNIT - 2

EVOLUTION OF POWER ELECTRONICS IN DRIVES: Power semiconductors devices used for drives control, GTO, BJT, power MOSFET, IGBT, MCT and IGCT structures, Ratings, comparison and their applications. Block diagram of power integrated circuit for D C motor drives. **4Hours**

UNIT - 3

A C MACHINE DRIVES: general classification and National Electrical Manufacturer Association (NEMA) classification, Speed control of Induction motors with variable voltage constant frequency, constant voltage variable frequency, (v/f) constant operation, drive operating regions. Variable stator current operation. Effect of Harmonics. **9 Hours**

UNIT - 4

SYNCHRONOUS MACHINE DRIVES: Wound field machine, comparison of Induction and wound field synchronous machines, Torque angle characteristics of salient pole synchronous machines, synchronous reluctance permanent magnet synchronous machines (SPM), variable reluctance machines (VRM).
8 Hours

PART - B

UNIT - 5

PHASE CONTROLLED CONVERTERS: Converter controls, Linear firing angle control, cosine wave crossing control, phase locked Oscillator principle, Electrro magnetic Interference (EMI) and line power quality problems, cyclo converters, voltage fed converters, Rectifiers, Current fed converters. **7 Hours**

UNIT - 6

PRINCIPLES OF SLIP POWER RECOVERY SCHEMES: Static Kramer's drive system, block schematic diagram, phasor diagram and limitations, Static Scherbins scheme system using D.C link converters with cyclo converter modes of operation, modified Scherbins Drive for variable source, constant frequency (VSCF) generation. **6 Hours**

UNIT - 7

PRINCIPLE OF VECTOR CONTROL OF A C DRIVES: Phasor diagram, digital Implementation block diagram, Flux vector estimation, indirect vector control block diagram with open loop flux control, synchronous motor control with compensation. **6 Hours**

UNIT - 8

EXPERT SYSTEM APPLICATION TO DRIVES (ONLY BLOCK DIAGRAM): Expert system shell, Design methodology, ES based P-I tuning of vector controlled drives system, Fuzzy logic control for speed controller in vector control drives,structure of fuzzy control in feedback system. **8 Hours**

TEXT BOOKS:

1. **Power Electronics & Motor Drives,**Bimal Bose, Elsevier 2006

2. **Modern Power Electronics & Drives,**Bimal K. Bose, Pearson Education 2003.

REFERENCE BOOK:

1. **Advanced Microprocessor and Interfacing,** Badri Ram, TMH, 1st Edition.

10EE763 DATA STRUCTURES

Subject Code	:	**10EE763**	**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

Design and Analysis of Algorithms: From problems to programs, Data Structures and Abstract Data types. **04 Hours**

UNIT – 2

Basic Data Type and Trees: Data types List, Implementation of lists, stacks Queues, Mappings, Stacks and recursive procedures. Basic terminology, ADT Tree, / Implementation of trees, Binary trees. **10 Hours**

UNIT – 3

Basic Operation on Sets: Introduction to sets an ADT with union intersection and difference, A Bit-vector implantation sets, A linked list implementation sets, The dictionary, simple dictionary implementation, the Hash table data structures, Estimating the efficiency of functions, Implementation of the mapping ADT, Priority Queues, Implementation of priority queues. **06 Hours**

UNIT – 4

Directed Graphs: Basic Definitions, Representation for directed graphs, the single source short path problems, Traversals of Directed Graphs, Directed A cyclic graphs, strong components. **06 Hours**

PART B

UNIT – 5

Sorting: The internal sorting model, simple sorting schemes, Quick sort Heapsort, Binsorting. **06 Hours**.

UNIT – 6

Algorithm analysis Techniques: Efficiency of algorithms, analysis of receive programs solving Recurrence Equations, A general solution for a large class of Recurrences. **06 Hours**

UNIT – 7

Algorithm Design Techniques: Divide and conquer algorithms, Dynamic programming, Greedy Algorithms, Back tracking, local search algorithms. **08 Hours**.

UNIT – 8

Data structures and Algorithm for external storage: A model of external computation, External sorting, sorting information in files, external search Trees. **08 Hours**

Text Book:

1.Data Structures and Algorithms, Alfred Aho, John E. Hopcroft and Jeffery D Ullaman, Pearson Education.

Reference Books:

1. **Introduction to Data structures and Algorithms with C+** by Gleen. W.Rowe, PHI Publications.
2. **Data structures using C & C++,** Langsam, Angenstein, Tenenbaum ,Pearson, 2nd edition,.
3. **Data Structures and Algorithm Analysis in C,** Weiss Mark Allen, Pearson Education,2nd Edition.

10EE764 VLSI CIRCUITS AND DESIGN

Subject Code	:	10EE764	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

A REVIEW OF MICROELECTRONICS AND AN INTRODUCTION TO MOS TECHNOLOGY: Introduction to integrated circuit technology. Introduction, VLSI technologies, MOS transistors, fabrication, thermal aspects, production of E-beam masks. **6 Hours**

UNIT - 2

BASIC ELECTRICAL PROPERTIES OF MOS AND BICMOS CIRCUIT: Drain to source current I_{ds} versus V_{ds} relationships-BICMOS latch up susceptibility. MOS transistor characteristics, figure of merit, pass transistor NMOS and COMS inverters, circuit model, latch up in CMOS circuits. **8 Hours**

UNIT - 3

MOS AND BICMOS CIRCUIT DESIGN PROCESSES: MOS layers, stick diagrams, design, symbolic diagrams. **8 Hours**

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance, capacitance layer inverter delays, wiring capacitance, choice of layers. **6 Hours**

PART - B

UNIT - 5

SCALING OF MOS CIRCUITS: Scaling model and scaling factors- Limitations due to current density. **8 Hours**

UNIT - 6

SUBSYSTEM DESIGN AND LAYOUT: Architectural issues, systems considerations. Examples of structural design, clocked sequential circuits. **8 Hours**

UNIT - 7

SUBSYSTEM DESIGN PROCESSES: General considerations, illustration of design process, observations. **4 Hours**

UNIT - 8

ILLUSTRATION OF THE DESIGN PROCESS: Observation on the design process, Regularity Design of an ALU subsystem. Design of 4-bit adder, implementation of ALU functions. **4 Hours**

TEXT BOOKS:

1. **Basic VLSI Design,** Douglas Pucknell &Eshragian**,** PHI, 3rd Edition, 2009.
2. **Fundamentals of Modern VLSI Devices,**Yuan Taun Tak H Ning Cambridge Press, South Asia Edition 2003,
3. **ModernVLSI Design,** Wayne wolf, Pearson Education Inc. 3rd edition, 2003.
4. **Introduction to CMOS VLSI Design-A Circuits and Systems Perspective,** Neil Weste,Pearson Education.3rd Edition.

10EE765 MICRO AND SMART SYSTEM TECHNOLOGY

Subject Code	:	10EE765	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 MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

b) What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.**5 Hours**

UNIT - 2

MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:

a) Definitions and salient features of sensors, actuators, and systems.

b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator

d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin. **8 Hours**

UNIT - 3

MICROMANUFACTURING AND MATERIAL PROCESSING:

a) Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.

b) Silicon micromachining: surface, bulk, moulding, bonding based process flows.

c) Thick-film processing:

d) Smart material processing:

e) Processing of other materials: ceramics, polymers and metals

f) Emerging trends **7 Hours**

UNIT - 4

MODELING:

a) Scaling issues.

b) Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.

c) Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators. **6 Hours**

PART - B

UNIT - 5

COMPUTER-AIDED SIMULATION AND DESIGN:

Background to the finite element element method. Coupled-domain simulations using Matlab. Commercial software. **8 Hours**

UNIT - 6

ELECTRONICS, CIRCUITS AND CONTROL:

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cycler. **8 Hours**

UNIT - 7

INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples. **6 Hours**

UNIT - 8

CASE STUDIES: BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam.

4 Hours

PART - C

UNIT - 9

Mini-projects and class-demonstrations (not for Examination)

9 Hours

a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)
b) BEL pressure sensor
c) Thermal-cycler for PCR
d) Active control of a cantilever beam

TEXT BOOKS AND A CD-SUPPLEMENT:

1. **MEMS & Microsystems: Design and Manufacture,** Tai-Ran Hsu, TMH, 1st Edition.
2. "Micro and Smart Systems" by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof. K.N.Bhat.,John Wiley Publications

REFERENCE BOOKS:

1. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
2. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.

3 Microsystems Design, S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.

4 Analysis and Design Principles of MEMS Devices, Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.

5. Design and Development Methodologies, Smart Material Systems and MEMS, V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.

6. MEMS- Nitaigour Premchand Mahalik, TMH 2007

10EE766 ELECTROMAGNETIC COMPATIBILITY

Subject Code	:	**10EE766**	**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: Designing of electromagnetic compatibility, EMC regulation, typical noise path, and use of network theory, method of noise coupling, miscellaneous noise sources, and method of eliminating interference. **8 Hours**

UNIT - 2 & 3

CABLING: Capacitive coupling, effect of shield on magnetic coupling, mutual inductance calculations, magnetic coupling between shield and inner conductor, shielding to prevent magnetic radiation, shielding a receptor against magnetic fields, shield transfer impedance, experimental data, example of selective shielding, co-axial cable versus shielded twisted pair braided shields, effect of pig tails, ribbon cable, electrically long cables. **10 Hours**

UNIT - 4

GROUNDING: Safety grounds, signal grounds, single point ground systems, hybrid grounds, multipoint ground systems, functional ground layout, practical low frequency grounding, hardware grounds, single ground reference for a circuit amplifier shields, grounding of cable shields, ground loops, low frequency analysis of common mode choke, high frequency analysis of common mode choke, differential amplifiers, shields grounding at high frequencies, guard shields guarded meters. **10 Hours**

PART - B

UNIT - 5

BALANCING AND FILTERING: Balancing, power supply decoupling, decoupling filters, amplifier decoupling driving capacitive loads, high frequency filtering, system bandwidth, and modulation and coding. **8 Hours**

UNIT - 6 & 7

SHIELDING: Near field and far fields, characteristic and wave impedance's shielding effectiveness, absorption loss, reflection loss, composite absorption and reflection loss, summary of shielding equation, shielding with magnetic material, experimental data, apertures, wave guide below cutoff, conductive gaskets, conductive windows, conductive coatings, cavity resonance, brooding of shields. **10 Hours**

UNIT - 8

ELECTROSTATIC DISCHARGE: State generation, human body model, static discharge, and ESD protection in equipment design, software and ESD protection, ESD versus EMC. **6 Hours**

TEXT BOOK:

1. **Noise reduction techniques in electronic systems**, Henry W. Ott, John Wiley, 2nd edition, 1988
3. **Engineering Electromagnetic Compatibility: Principles, Measurements & Technologies,** V. Prasad Kodali, S. Chand & Co. Ltd. Delhi, 2000.

REFERENCE BOOKS:

1. Electromagnetics Explained – A Hand Book For Wireless/Rf,Emc And High Speed Electronoics.

10EEL77 Relay and High Voltage Laboratory

Subject Code	:	10EEL77	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

(Total 12 experiments are to be conducted by choosing at least 03 experiments from part A, 02 each from part-B and C and 05 from part-D)

PART - A

1. Over current relay **:**
   (a) IDMT non-directional characteristics
   (b) Directional features
   (c) IDMT directional
2. IDMT characteristics of over voltage or under voltage relay.(solid state or electromechanical type
3. (a) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.
   (b) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator.
   Operating characteristics of over voltage or under voltage relay. (Solid state or electromechanical type).
4. Operation of negative sequence relay.
5. Bias characteristics of differential relay.
6. Current-time characteristics of fuse.

PART - B

1. Operating characteristics of microprocessor based (numeric) over –current relay.
2. Operating characteristics of microprocessor based (numeric) distance relay.
3 Operating characteristics of microprocessor based (numeric) over/under voltage relay.

PART - C

1. Generator protection –Merz-Price- protection scheme.
2. Feeder protection scheme-fault studies.
3. Motor protection scheme-fault studies.

PART - D

1. Spark over characteristics of air insulation subjected to high voltage AC with spark over voltage corrected to STP.
2 Spark over characteristics of air insulation subjected to high voltage AC, with spark over voltage corrected to STP for uniform and non-uniform field configuration.
3 Spark over characteristics of air insulation subjected to high voltage DC
4 Measurement of HVAC and HVDC using standard spheres.
5 Breakdown strength of transformer oil using oil-testing unit.
6. Field mapping using electrolytic tank for any one-model cable/capacitor/transmission line/ Sphere gap models.

10EEL78 Power System Simulation Laboratory

Subject Code	:	**10EEL78**	**IA Marks**	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

Power system simulation using MATLAB/ C or C ++ /Sci lab /octave

1. a) Y Bus formation for power systems with and without mutual coupling, by singular transformation and inspection method.
   b) Determination of bus currents, bus power and line flow for a specified system voltage (Bus) Profile
2. Formation of Z-bus(without mutual coupling) using Z-bus building Algorithm .
3. ABCD parameters: Formation for symmetric π/T configuration. Verification of AD-BC=1 Determination of efficiency and regulation
4. Determination of power angle diagrams, reluctance power, excitation, emf and regulation for salient and non-salient pole synchronous machines,.

5 To obtain swing curve and to determine critical clearing time and regulation for a single machine connected to infinity bus through a pair of identical transmission lines under 3-phase fault on one of the lines for variation of inertia constant/line parameters /fault location/clearing time/pre-fault electrical output.

6. Formation of Jacobian for a system not exceeding 4 buses (no PV buses) in polar coordinates
7. Write a program to perform load using Gauss- Seidel method (only p q bus)
8. To determine fault currents and voltages in a single transmission line system with star-delta transformers at a specified location for LG, LLG.
9. Load flow analysis using Gauss Siedel method, NR method, Fast decoupled method for both pq and pv buses.
10. Optimal Generation Scheduling for Thermal power plants.

Note: Questions 1-7: Simulation Experiments using MATLAB/C or C++/Scilab/Octave
Questions 8-10: Use suitable standard software package.

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FINAL SCHEME OF TEACHING & EXAMINATION AND SYLLABUS - DATED 16TH AND 17TH APRIL 2010

VIII SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE81	Electrical Design, Estimating and Costing	E&EE	4	-	3	25	100	125
2	10EE82	Power System Operation and Control	E&EE	4	-	3	25	100	125
3	10EE83X	Elective-IV (Group D)	E&EE	4	-	3	25	100	125
4	10EE84X	Elective-V (Group E)	E&EE	4	-	3	25	100	125
5	10EEP85	Project Work	E&EE	-	6	3	100	100	200
6	10EES86	Seminar (on a latest topic relevant to the branch and independent of the project work)	E&EE	-	3	-	50	-	50
Total				16	09	15	250	500	750

Elective-IV (Group-D)

10EE831 - Reactive Power Management
10EE832 - Flexible A.C. Transmission Systems (FACTS)
10EE833- Advanced Instrumentation System
10EE834 - AI Applications to Power Systems
10EE835 - Data Base Management Systems (DBMS)
10EE836 - Renewable Energy Sources

Elective-V (Group-E)

10EE841 - Power Systems Dynamics and Stability
10EE842 - Energy Auditing & Demand Side management
10EE843 - Data communications and Networking
10EE844 - Electrical Distribution Systems
10EE845 - Insulation Engineering
10EE846 - Intellectual Property Rights
10EE847 - Electrical Power Quality

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.

10EE843 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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