III SEMESTER SYLLABUS
Electrical & Electronics Engg

ENGINEERING MATHEMATICS – III

Sub Code : 06MAT31 **IA Marks : 25**
Hrs/ Week : 04 **Exam Hours : 03**
Total Hrs. : 52 **Exam Marks : 100**

PART – A

UNIT 1:
Fourier Series
Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

7 Hours

UNIT 2:
Fourier Transforms
Finite and Infinite Fourier transforms, Fourier sine and consine transforms, properties. Inverse transforms.

6 Hours

UNIT 3:
Partial Differential Equations (P.D.E)
Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $P p + Q q = R$.

6 Hours

UNIT 4:
Applications of P.D.E
Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions. (Boundary value problems).

7 Hours

PART – B

UNIT 5:
Numerical Methods
Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordon methods. Gauss – Seidel iterative method. Definition of eigen values and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

6 Hours

UNIT 6:
Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule. (All formulae / rules without proof)

7 Hours

UNIT 7:
Calculus of Variations
Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and rachistochrone problems.

6 Hours

UNIT 8:

Difference Equations and Z-transforms

Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations.

7 Hours

SUBJECT CODE: **06ES32** IA MARKS: 25
SUBJECT: **ANALOG ELECTRONIC CIRCUITS** EXAM HOURS: 3
HOURS / WEEK: 4 EXAM MARKS: 100
TOTAL HOURS: 52

PART – A

UNIT 1:
Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers. (Chapter 1.6 to 1.14, 2.1 to 2.9)

06 Hours

UNIT 2:
Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization. (Chapter 4.1 to 4.12)

07 Hours

UNIT 3:
Transistor at Low Frequencies: BJT transistor modeling, Hybrid equivalent model, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Hybrid equivalent model. **(**Chapter 5.1 to 5.3, 5.5 to 5.17)

07 Hours

UNIT 4:
Transistor Frequency Response: General frequency considerations, low frequency response, Miller effect capacitance, High frequency response, multistage frequency effects. (Chapter 9.1 to 9.5, 9.6, 9.8, 9.9)

06 Hours

PART – B

UNIT 5:
(a) General Amplifiers: Cascade connections, Cascode connections, Darlington connections. (Chapter 5.19 to 5.27)

03Hours

(b) Feedback Amplifier: Feedback concept, Feedback connections type, Practical feedback circuits. (Chapter 14.1 to 14.4)

03 Hours

UNIT 6:
Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions. (Chapter 12.1 to 12.9)

07 Hours

UNIT 7:
Oscillators: Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (Chapter 14.5 to 14.11) (BJT version only)

06 Hours

UNIT 8:
FET Amplifiers: FET small signal model, Biasing of FET, Common drain common gate configurations, MOSFETs, FET amplifier networks. (Chapter 8.1 to 8.13)

07 Hours

TEXT BOOK:

1. **Robert L. Boylestad and Louis Nashelsky**, "Electronic Devices and Circuit Theory", PHI. 9TH Edition.

REFERENCE BOOKS:

1. **Jacob Millman & Christos C. Halkias**, 'Integrated Electronics', Tata - McGraw Hill, 1991 Edition

2 . **David A. Bell**, "Electronic Devices and Circuits", PHI, 4th Edition, 2004 **Question Paper Pattern:** Student should answer FIVE full questions out of 8 questions to be set each carrying 20 marks, **selecting at least TWO questions from each part**.

SUBJECT CODE: **06ES 33**

SUBJECT: **LOGIC DESIGN** EXAM HOURS: 3

HOURS / WEEK: 4 EXAM MARKS: 100

TOTAL HOURS: 52 IA MARKS: 25

Part –A

Unit 1:

Principles of combinational logic-1: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations. [(Text book 1) 3.1, 3.2, 3.3, 3.4]

7 Hours

Unit 2:

Principles of combinational Logic-2: Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables [(Text book 1) 3.5, 3.6]

7 Hours

Unit 3:

Analysis and design of combinational logic - I: General approach, Decoders-BCD decoders, Encoders. [(Text book 1) 4.1, 4.3, 4.4]

6 Hours

Unit 4:

Analysis and design of combinational logic - II: Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractors - Cascading full adders, Look ahead carry, Binary comparators. [(Text book 1) 4.5, 4.6 - 4.6.1, 4.6.2, 4.7]

6 Hours

Part –B

Unit 5:

Sequential Circuits – 1: Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The $\overline{S}\,\overline{R}$ Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip- Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop. [(Text book 2) 6.1, 6.2, 6.4, 6.5].

7 Hours

Unit 6:

Sequential Circuits – 2: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops [(Text book 2) 6.6, 6.7, 6.8, 6.9 – 6.9.1 and 6.9.2]

7 Hours

Unit 7:

Sequential Design - I: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis, [(Text book 1) 6.1, 6.2, 6.3]

6 Hours

Unit 8:

Sequential Design - II: Construction of state Diagrams, Counter Design [(Text book 1) 6.4, 6.5]

6 Hours

Text books:

1. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
2. Donald D Givone, "Digital Principles and Design ", Tata McGraw Hill Edition, 2002.

Reference Books:

1. Charles H Roth, Jr; "Fundamentals of logic design", Thomson Learning, 2004.
2. Mono and Kim, "Logic and computer design Fundamentals", Pearson, Second edition, 2001.

SUBJECT CODE: **06ES34**
SUBJECT: **NETWORK ANALYSIS** EXAM HOURS: 3
EXAM MARKS: 100 IA MARKS: 25
HOURS / WEEK: 4 TOTAL HOURS: 52

PART – A

UNIT 1:

Basic Concepts: 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, 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 .

06 Hours

UNIT 4:

Network Theorems - II:

Thevinin's and Norton's theorems; Maximum Power transfer theorem

06 Hours

PART – B

UNIT 5: Resonant Circuits: Series and parallel resonance, frequencyresponse of series and Parallel circuits, Q –factor, Bandwidth.

06Hours

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.

07 Hours

UNIT 7:

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

07 Hours

UNIT 8:

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

06 Hours

TEXT BOOKS:

1. M. E. Van Valkenburg, "Network Analysis", PHI / Pearson Education, 3rd Edition. Reprint 2002

2. Roy Choudhury, "Networks and systems", 2nd edition, 2006 re-print, New Age International Publications

REFERENCE BOOKS :

1. **Hayt, Kemmerly and Durbin**, "Engineering Circuit Analysis ", TMH 6th Edition, 2002
2. **Franklin F. Kuo**, "Network analysis and Synthesis", Wiley International Edition,
3. **David K. Cheng**, "Analysis of Linear Systems", Narosa Publishing House, 11th reprint, 2002

4. **A. Bruce Carlson**, "Circuits", Thomson Learning, 2000. Reprint 2002 **Question Paper Pattern:** Student should answer FIVE full questions out of 8 questions to be set each carrying 20 marks, **selecting at least TWO questions from each part**.

SUBJECT CODE: **06EE35**
SUBJECT: **ELECTRICAL MEASUREMENTS** EXAM HOURS: 3
EXAM MARKS: 100 IA MARKS: 25
HOURS / WEEK: 4 TOTAL HOURS: 52

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

3 Hours (8 Marks)

(b) Measurement of Resistance, Inductance, and Capacitance: Wheatstone's bridge — sensitivity analysis, limitations. Kelvin's double bridge.

(4 Hrs -12 Marks)

Unit 2:
(a) Earth resistance measurement using Megger. Measurement of earth resistance by fall of potential method. Anderson's bridge. Schering bridge. Sources and detectors, Schielding of bridges. Problems –

6 Hours (20 Marks)

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) —

7 Hours (20 Marks)

Unit 4:
Measurement of Power and Related Parameters: Dynamometer wattmeter. LPF wattmeter. 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.

— **7 Hours (20 Marks)**

Unit 5:
(a) Construction and operation of electro-dynamometer single-phase power factor meter. Weston frequency meter and phase sequence indicator. –

3 Hours (10 Marks)

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

3 Hours (10 Marks)

Unit 6:
Dual trace oscilloscope — front panel details of a typical dual trace oscilloscope. Method of measuring amplitude, phase, frequency, period. Use of Lissajous patterns. Working of a digital storage oscilloscope.

— 7 Hours (20 Marks)

Unit 7:
Trans ducers: Classification and selection of transducers. Strain gauges. LVDT. Temperature measurements. Photo conductive and photo-voltaic cells.

— 6 Hours (20 Marks)

Unit 8:

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

– 2 Hous (8 Marks)

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

— 4 Hours (12 Marks)

Text Books

1. A. K. Sawhney, "Electrical and Electronic Measure ments and Instrumentation", Dhanpatrai and Sons, New Delhi.
2. Cooper D. and A.D. Heifrick, "Modern Electronic Instrumentation and Measuring Techniques", P.H.I.

References

1. Golding and Widdies, "Electrical Measurements and Measuring Instruments", Pitman.
2. David A. Bell, "Electronic Instrumentation and Measurement", 2nd Edition, P.H.I., 2006.
3. Harris, "Electric Measurements", John Wiley.

SUBJECT CODE: **06EE36** IA MARKS: 25
SUBJECT: **ELECTRIC POWER GENERATION** EXAM HOURS: 3
EXAM MARKS: 100 HOURS / WEEK: 4

Unit 1:

Sources of Electrical Power: Wind, solar, fuel, tidal, geo-thermal, hydroelectric, thermal, diesel, gas, nuclear power plants (block diagram approach only). Concept of co-generation. Combined heat and power distributed generation. **– 6 Hours (20 Marks)**

Unit 2:

Diesel electric plants. Gas turbine plants. Mini, micro, and bio generation. Concept of distributed generation. **— 6 Hours (20 Marks)**

Unit 3:

(a) Hydro Power Generation: Selection of site. Classification of hydroelectric plants. General arrangement and operation. Hydroelectric plant power station structure and control.

— 4 Hours (10 Marks)

(b) Thermal Power Generation: Introduction. Main parts of a thermal power plant. Working. Plant layout. **— 3 Hours (10 Marks)**

Unit 4:

Nuclear Power Station: Introduction. Adverse effects of fossil fuels. 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 (20 Marks)**

Unit 5:

Economics Aspects: Introduction. Terms commonly used in system operation. Diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor, loss factor, load duration curve. **– 7 Hours (20 Marks)**

Unit 6:

(a) Power factor improvement and tariffs. Energy-load curve. Interconnection of power stations. **—**

3 Hours (10 Marks)

(b) Substations: Introduction. Types. Bus bar arrangement. Schemes. Location. Substation equipment. Reactors and capacitors. **— 4 Hours (10 Marks)**

Unit 7:
(a) Current limiting reactors. Symmetric short circuit MVA calculations. **– 3 Hours (10 Marks)**
(b) Grounding Systems: Introduction. Resistance grounding systems. Neutral grounding. Ungrounded system. **– 3 Hours (10 Marks)**

Unit 8:
Resonant grounding. Solid grounding, reactance grounding, resistance grounding. Earthing transformer. Neutral grounding transformer. 7 **Hours (20 Marks)**

Text Books
1. A. Chakrabarti, M. L. Soni, and P.V. Gupta, "Power System Engineering", Dhanpat Rai and Co., New Delhi.
2. M. V. Deshpande, "Elements of Power System Design", A. H. Wheeler and Co.
References
1. S. M. Singh, "Electric Power Generation, Transmission and Distribution", P.H.I., New Delhi.

SUBJECT CODE: **06ESL 37** IA MARKS: 25
SUBJECT: **ANALOG ELECTRONICS LAB** EXAM HOURS: 3
EXAM MARKS: 50 HOURS / WEEK: 3

1. Wiring of RC coupled Single stage FET & BJT amplifier and determination of the gain-frequency response, input and output impedances.
2. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit) (One Experiment)
3. Wiring of a two stage BJT Voltage series feed back amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback (One Experiment)
4. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for f_0 = 10 KHz
5. Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range f_0 =100KHz.
6. Testing for the performance of BJT -Crystal Oscillator for f_0 > 100 KHz
7 Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection
8. Testing of Clamping circuits: positive clamping /negative clamping.
9. Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.
10. Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency
11. Verification of Thevinin's Theorem and Maximum Power Transfer theorem for DC Circuits.
12. Characteristics of Series and Parallel resonant circuits.

SUBJECT CODE: **06ESL 38** IA MARKS: 25
SUBJECT: LOGIC DESIGN LAB EXAM HOURS: 3
EXAM MARKS: 50 HOURS / WEEK: 3

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.
   (i) Realization of parallel adder/Subtractors using 7483 chip
   (ii) BCD to Excess-3 code conversion and vice versa.
3. Realization of Binary to Gray code conversion and vice versa MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.
4. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
5. Use of a) Decoder chip to drive LED display and b) Priority encoder.
6. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
7. Realization of 3 bit counters as a sequential circuit and MOD – N counterdesign (7476, 7490, 74192, 74193).
8. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.
9. Wiring and testing Ring counter/Johnson counter.
10. Wiring and testing of Sequence generator.

FOURTH SEMESTER
Electrical & Electronics Engg

ENGINEERING MATHEMATICS - IV

Sub Code : 06MAT41 **IA Marks : 25**
Hrs/ Week : 04 **Exam Hours : 03**
Total Hrs. : 52 **Exam Marks : 100**

PART – A

UNIT 1:
Numerical Methods
Numerical solutions of first order and first degree ordinary differential equations – Taylor's series method, Modified Euler's method, Runge – Kuttamethod of fourth order, Milne's and Adams -Bashforth predictor and corrector methods (All formulae without Proof).

6 Hours

UNIT 2:
Complex Variables
Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in Cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition. Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (I/z)$, z **?** 0 Bilinear transformations.

7 Hours

UNIT 3:
Complex Integration
Complex line integrals, Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series (Statements only) Singularities, Poles, Residues, Cauchy's residue theorem (statement only).

6 Hours

UNIT 4:
Series solution of Ordinary Differential Equations and Special Functions Series solution – Frobenius method, Series solution of Bessel's D.E. leading to Bessel function of fist kind. Equations reducible to Bessel's D.E., Series solution of Legendre's D.E. leading to Legendre Polynomials. Rodirgue's formula.

7 Hours

PART – B

UNIT 5:
Statistical Methods
Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$, $y = ax^b$ $y = ab^x$, $y = ae^{bx}$, Correlation and Regression. Probability: Addition rule, Conditional probability, Multiplication rule, Baye's theorem.

6 Hours

UNIT 6:
Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson, Normal and Exponential distributions.

7 Hours

UNIT 7:
Sampling, Sampling distribution, Standard error. Testing of hypothesis for means. Confidence limits for means, Student's t distribution, Chi-square distribution as a test of goodness of fit.

7 Hours

UNIT 8:
Concept of joint probability – Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient. Probability vectors, Stochastic

matrices, Fixed points, Regular stochastic matrices. Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.

6 Hours

SUBJECT CODE: **06ES42** IA MARKS: 25
SUBJECT: **MICROCONTROLLERS** EXAM HOURS: 3
(Common to, EE, EC, IT, TC, BM and ML) EXAM MARKS: 100
HOURS / WEEK: 4 TOTAL HOURS: 52

PART – A

UNIT 1:

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, A Microprocessors survey. RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. **The 8051 Architecture:** Introduction, 8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits External Memory, Counter and Timers, Serial Data Input / Output, Interrupts. **07 Hrs**

UNIT 2:

Addressing Modes and Operations: Introduction, Addressing modes, External data Moves, Code Memory, Read Only Data Moves / Indexed Addressing mode, PUSH and POP Opcodes, Data exchanges, Example Programs; Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Example Programs. **07 Hrs.**

UNIT 3:

Jump and Call Instructions: The JUMP and CALL Program range, Jumps, calls and Subroutines, Interrupts and Returns, More Detail on Interrupts, Example Problems. **06 Hrs.**

UNIT 4:

8051 programming in C: Data types and time delays in 8051C, I/O programming, logic operations, data conversion programs, accessing code ROM space, data serialization.

06 Hrs

PART – B

UNIT 5:

Timer / Counter Programming in 8051: Programming 8051 Timers, Counter Programming, programming timers 0 and 1 in 8051 C **06 Hrs**

UNIT 6:

8051 Serial Communication: Basics of Serial Communication, 8051 connections to RS-232, 8051 Serial communication Progra mming, Programming the second serial port, Serial port programming in C. **07 Hrs**

UNIT 7:

Interrupts Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051/52, Interrupt programming in C

06 Hrs

UNIT 8:

8051 Interfacing and Applications: Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing, DC motor interfacing and PWM

07 Hrs

Text Books:

1. Kenneth J. Ayala ; "The 8051 Microcontroller Architecture, Programming & Applications" 2e, Penram International, 1996 / Thomson Learning 2005

2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C "- PHI, 2006 / Pearson, 2006

Reference Book:

1. Predko ; "Programming and Customizing the 8051 Microcontroller" –, TMH

2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005

3. Ajay V.Deshmukh; "Microcontrollers- Theory and Applications",TMH,2005

4. Dr.Ramani Kalpathi and Ganesh Raja; "Microcontroller and its applications", Sanguine Technical publishers,Bangalore-2005

Question Paper Pattern: Student should answer FIVE full questions out of
8 questions to be set each carrying 20 marks, **selecting at least TWO questions fr om each part**

SUBJECT CODE: **06ES43** IA MARKS: 25
SUBJECT: **CONTROL SYSTEMS** EXAM HOURS: 3
(Common to EC/TC/EE/IT/BM/ML) EXAM MARKS: 100
HOURS / WEEK: 4 TOTAL HOURS: 52

PART – A

UNIT 1:

Modeling of Systems: The control system, Mathematical models of physical systems – Introduction, Differential equations of physical systems – Mechanical systems, Friction, Translational systems (Mechanical accelerometer, Levered systems excluded), Rotational systems, Gear trains, Electrical systems, Analogous systems

06 Hours

UNIT 2:

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded), **07 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 – static errors and error constants. **07 Hours**

UNIT 4:

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis; More on the Routh stability criterion.

06 Hours

PART – B

UNIT 5:

Root–Locus Techniques: Introduction, The root locus concepts, Construction of root loci. **06 Hours**

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

07 Hours

UNIT 7:
Frequency domain analysis: Introduction, 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.

07 Hours

UNIT 8:
Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations. **06 Hours**

TEXT BOOK :
I. J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, Fourth edition – 2005

REFERENCE BOOKS:
1. K. Ogata, "Modern Control Engineering ", Pearson Education Asia/ PHI, 4th Edition, 2002.
2. P. S. Satyanarayana; "Concepts of Control Systems", Dynaram publishers, Bangalore, 2001
3. M. Gopal, "Control Systems – Principles and Design", TMH, 1999
4. J. J. D'Azzo and C. H. Houpis; "Feedback control system analysis and synthesis", McGraw Hill, International student Edition.
Question Paper Pattern: Student should answer FIVE full questions out of 8 questions to be set each carrying 20 marks, **selecting at least TWO questions from each part**

****

SUBJECT CODE: **06ES 36 / 44** IA MARKS: 25
SUBJECT: **FIELD THEORY** EXAM HOURS: 3
(Common to EC/TC/ML/EE) EXAM MARKS: 100
HOURS / WEEK: 4 TOTAL HOURS: 52

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 (Chapter 2 – 2.1, 2.2, 2.3 2.4)

03 Hours

b. **Electric flux density, Gauss' law and divergence:** Electric flux density, Gauss' law, Divergence, Maxwe ll's First equation(Electrostatics), vector operator $\tilde{\mathbf{N}}$ and divergence theorem(Chapter 3 – 3.1, 3.2, 3.5, 3.6, 3.7)

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 (Chapter 4 – 4.1, 4.2, 4.3, 4.4, 4.5 4.6, 4.8)

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. **(**Chapter 5 - 5.1, 5.2, 5.3, 5.4; Chapter 6 – 6.2, 6.3, 6.4) **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 (Chapter 7 – 7.1, 7.2, 7.3, 7.4)

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 (Chapter 8 – 8.1, 8.2, 8.3, 8.4, 8.5, 8.6)

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. (Chapter 9 – 9.1, 9.2, 9.3, 9.4) **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. (Chapter 9 – 9.6, 9.7, 9.8, 9.9, 9.10) **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(Chapter 10) **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). **(** Chapter 12 – 12.1 to 12.4) **07 Hours**

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. (Chapter 13 – 13.1, 13.2, 13.4) **06 Hours**

TEXT BOOK:

William H Hayt Jr. and John A Buck, "Engineering Electromagnetics", Tata McGraw-Hill, 7th edition, 2006

REFERENCE BOOKS :

1. John Krauss and Daniel A Fleisch, "Electromagnetics with Applications", McGraw-Hill, 5th edition, 1999

2. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves And Radiating Systems," Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002

3. David K Cheng, "Field and Wave Electromagnetics" Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

4. Matthew N.O. Sadiku, Elements of Electromagnetics, 3rd Edition, Oxford University Press, 2000, ISBN: 0-19-514497-X.

Question Paper Pattern: Student should answer FIVE full questions out of 8 questions to be set each carrying 20 marks, **selecting at least TWO questions from each part Coverage in the Text book:**

****

SUBJECT CODE: **06EE45** IA MARKS: 25
SUBJECT: POWER ELECTRONICS EXAM HOURS: 3
(For EE Only) EXAM MARKS: 100
HOURS / WEEK: 4 TOTAL HOURS: 52

Part A

Unit 1:

Introduction, Power Semiconductor Devices:

Applications of Power Electronics, Power semiconductor devices, Control Characteristics. Types of power electronic circuits. Peripheral effects. – **6 hours (20 Marks)**

Unit 2:

Power Transistors: Power BJT's **–** switching characteristics, switching limits, base drive control. Power MOSFET's – switching characteristics, gate drive. IGBT's, di/dt and dv/dt limitations. Isolation of gate and base drives. Simel design of gate and base drives. **– 6 Hours (20 marks)**

Unit 3:
Thyristors
Introduction, characteristics. Two Transistor Model. Turn-on and turn-off. di/dt and dv/dt protection. Thyristor types. Series and parallel operation of Thyristors. Thyristor firing circuits. Sample design of firing circuits using UJT, op-amps, and digital IC's. **– 7 Hours (20 Marks)**

Unit 4:
Communication Techniques: Introduction. Natural Commutation. Forced commutation: self commutation, impulse commutation, resonant pulse commutation and complementary commutation. **– 6 Hours (20 Marks)**

Unit 5: AC Voltage Controllers: Introduction. Principle of ON-OFF and phase control. Single - phase bidirectional controllers with resistive and inductive loads.**– 6 Hours (20 Marks)**

Unit 6:
Controlled Rectifiers: Introduction. Principle of phase controlled converter operation. Single-phase semi-converters. Full converters. Three-phase halfwave converters. Three-phase full-wave converters. **– 7 Hours (20 Marks**)

Unit 7:
DC 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) **– 7 Hours (20 Marks)**

Unit 8:
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. Variable D.C. link inverter. **– 7 Hours (20 Marks)**

Text Book:
1) M.H.Rashid "Power Electronics", 2nd Edition, P.H.I. /Pearson, New Delhi, 2002
References
1. Net Mohan, Tore M. Undeland, and William P. Robins, "Power Electronics – Converters, Applications and Design", Third Edition, John Wiley and Sons.
2. G.K. Dubey, S.R. Doradla, A. Joshi and R.M.K. Sinha, "Thyristorised Power Controllers", New Age International Publishers.
3. M.D. Singh and Khanchandani K.B., "Power Electronics", T.M.H., 2001.
4. Cyril Lander, "Power Electronics", 3rd Edition, McGraw-Hill.
5. J.M. Jacob, "Power Electronics: Principles and Applications", Thomson – Vikas Publications.
6. R.S. Ananda Murthy and V. Nattarasu, "Power Electronics : A Simplified Approach", Sanguine Technical Publishers.

****

SUBJECT CODE: **06EE46** IA MARKS: 25
SUBJECT: **TRANSFORMERS AND INDUCTION MACHINES** EXAM HOURS: 3
(For EE Only) EXAM MARKS: 100
HOURS / WEEK: 4 TOTAL HOURS: 52

Unit 1:
Basic Concepts: Concept of coupled circuits. Dot convention. Writing network equilibrium equations in coupled circuits (problems on coupled circuits excluded). Principle of transformer action for voltage transformation. Constructional details of shell type and core type of single-phase and threephase transformers. Description of the following types of transformers — power transformer, distribution transformer, constant voltage transformer, constant current transformer, variable frequency transformers, autotransformers. **— 6 Hours (20 Marks)**

Unit 2:
Single-phase Transformers: Concept of ideal transformer. Equation for E.M.F. induced in the two windings. Voltage transformation ratio. Ideal transformer on no-load and loaded condition with corresponding phasor diagrams. Concept of M.M.F. balance in the magnetic circuit of an ideal transformer. Current transformation ratio. Concept of referring impedance connected on one side of ideal transformer to the other side. Practical transformer – how it deviates from the ideal transformer. Development of
exact equivalent circuit of a practical transformer – visualization of a practical transformer as an ideal transformer combined with imperfections of electric and magnetic circuits. Approximate equivalent circuit of a practical transformer. **– 6 Hours (20 Marks)**

Unit 3:
Phasor diagram of a practical transformer for both no-load and loaded conditions. Losses, power and all-day efficiency, regulation. Testing of transformers — O.C. test, S.C. test and predetermination of efficiency and regulation. Sumpner's test. Parallel operation — need, conditions to be satisfied for parallel operation. Load sharing. **— 6 Hours (20 Marks)**

Unit 4:
Three-phase Transformers: All types of three-phase transformer connections including open delta. Choice of connection. Bank of singlephase transformers for three-phase operation. Phase conversion using
transformers. 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 proper operation of threephase transformers in parallel. **— 7 Hours (20 Marks)**

Unit 5:
(a) Three-winding Transformers: Advantages and disadvantages of threewinding transformers. Equivalent circuit. **— 2 Hours (5 Marks)**
(b) Basic Concepts of Induction Machines: Concept of rotating magnetic field. Operating principle, construction, classification and types — singlephase, three-phas e, squirrel-cage, slip-ring, double-cage types.**— 5 Hours (15 Marks)**

Unit 6:
Three-phase Induction Motor: Phasor diagram of induction motor on noload and loaded conditions. Visualization of a three-phase induction motor as a generalized transformer with a rotating secondary and obtaining its equivalent circuit. Different kinds of power losses in an induction motor. Efficiency. Performance evaluation — output power, torque, efficiency, current and power factor. **– 7 Hours (20 Marks)**

Unit 7:
Torque-slip characteristics covering motoring, generating and braking regions of operation. Induction generator. No-load and blocked rotor tests. Circle diagram and therefrom performance evaluation of the motor. Cogging and crawling. Equivalent circuit and performance of double-cage and deepbar motors. **— 6 Hours (20 Marks)**

Unit 8:
(a) Starting and Control of Three-phase Induction Motor: Need for starter. DOL, Y-Delta and auto-transformer starting. Rotor resistance starting. Electronic starters (any one type). Speed control — voltage, frequency, and rotor resistance variations.**— 4 Hours (10 Marks)**

(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. **— 3 Hours (10 Marks)**

Text Books

1. Alexander Langsdorf, "Theory of Alternating Current Machines", T.M.H.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", 2nd Edition, T.M.H., ISBN 0-07-463285-X.

References

1. M. G. Say, "Performance and Design of A.C. Machines", C.B.S. Publishers.
2. Ashfaq Hussain, "Electrical Machines", Dhanpatrai and Co.
3. Kosco, "Electrical Machines and Transformers", P.H.I.

****

SUBJECT CODE: **06ESL47** IA MARKS: 25
SUBJECT: **MICROCONTROLLERS LAB** EXAM HOURS: 3
(Common to, EE, EC, IT, TC, BM and ML) EXAM MARKS: 50
HOURS / WEEK: 3 TOTAL HOURS: 42

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable)
3. Counters
4. Boolean & Logical Instructions (Bit manipulations)
5. Conditional CALL & RETURN
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter

II. INTERFACING:

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions
8. Simple Calculator using 6 digit seven segment display and Hex Keyboard interface to 8051
9. Alphanumeric LCD panel and Hex keypad input interface to 8051
10. External ADC and Temperature control interface to 8051
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude
12. Stepper and DC motor control interface to 8051
13.. Elevator interface to 8051

SUBJECT CODE: **06EEL48**	IA MARKS: 25
SUBJECT: **POWER ELECTRONICS LAB**	EXAM HOURS: 3
(For EE Only)	EXAM MARKS: 50
HOURS / WEEK: 3	TOTAL HOURS: 42

NOTE: Each student has to do any one of the experiments given below in the examination individually.

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 OR A.C. voltage controller.
5. Single -phase 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 a stepper motor.
9. Speed control of a universal motor and a single -phase induction motor using A.C. voltage controller.
10. MOSFET OR IGBT based single-phase full-bridge inverter connected to R load.

****

V SEMESTER SYLLABUS

Electrical & Electronics Engg

V SEMESTER
MANAGEMENT AND ENTREPRENEURSHIP

Subject Code : **06AL51** 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

MANAGEMENT: Introduction- meaning nature & characteristic of management, scope & functional areas of management. Management as a science, art or profession, management and Administration, Role of management, levels of management, Development of management thought – early management approaches – modern management and approaches

7 Hours

UNIT - 2

PLANNING: Nature, Importance and purpose of planning process, objectives, types of plans (meaning only), decision – making, importance of planning, steps in planning and planning premises, Hierarchy of plans

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization, principles of organization, Types of organization – Departmentation – committees – centralization v/s decentralization of authority and responsibility, span of control- MBO and MBE (meaning only), nature and importance of staffing, process of selection and recruitment (in brief)

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing, leadership styles, motivation theories, communication- meaning and importance, co-ordination, meaning and importance, techniques of coordination, Meaning and steps in controlling, essentials of a sound control system, methods of establishing control (in brief)

7 Hours

PART - B

UNIT - 5

ENTREPRENEUR: Meaning of entrepreneur, evaluation of the concept, function of an entrepreneur types of entrepreneur, evolution of entrepreneurship, development of entrepreneurship, stages in entrepreneurial process, role of entrepreneurs in economic development entrepreneurship in India, entrepreneurship - its barriers

6 Hours

UNIT - 6

SMALL SCALE INDUSTRY: Definition, characteristics, need and rationale, objectives, scope, role of SSI in economic development, advantages of SSI, steps to start an SSI – Govt policy towards SSI, different policies of SSI, Govt support for SSI during 5 year plans. Impact of liberalization, privatization, globalization on SSI, effect of WTO/ GATT, supporting agencies of Govt for SSI, meaning; nature of support, objectives, and functions, types of help, ancillary industry and tiny industry (Definition only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes, TECKSOK, KIADB, KSSIDC, KSIMC, DIC single window Agency SISI, NSIC, SIDBI, KSFC

6 Hours

UNIT - 8

PREPARATION OF PROJECT-Meaning of Project; Project Identification Project Selection Project Report, Need and significance of Report, Contents, Formulation Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report, Project Appraisal, Identification of Business Opportunities. Market Feasibility Study, Technical Feasibility study, Financial Feasibility Study & Social Feasibility study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** - PC Tripati, P N Reddy,–THM Hill,
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House –
3. **Entrepreneurship Development** – small Business Enterprises Poornima M Charanthmath Pearson Education – 2005

REFERENCE BOOKS:

1. **Management Fundamentals** - Robert Lusier,– Concepts, Application, Skill Development" Thomson
2. Entrepreneurship Development - S S Khanka S Chand & Co
3. **Management** - Stephan Robbins Pearson Education/PHI 17th Edition 2003.

SIGNALS AND SYSTEMS

Subject Code : **06EE52** 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

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

10 Hours

UNIT - 3

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)

8 Hours

PART - B

UNIT - 4

THE CONTINUOUS-TIME FOURIER TRANSFORM-Representation of a periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform

4 Hours

UNIT - 5

THE DISCRETE-TIME FOURIER TRANSFORM-Representations of periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT.

4 Hours

UNIT - 6

APPLICATION OF FOURIER REPRESENTATIONS-Frequency response of LTI systems, solution of differential and difference equations using system function, sampling of continuous time signals and signal reconstruction(only low pass).

8 Hours

UNIT - 7

Z- TRANSFORMS-Introduction, Z-transform, properties of ROC properties of Z-transforms, inversion of Z-transforms 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

8 Hours

TEXT BOOKS:

1. **Signals and Systems-** Simon Haykin and Barry Van Veen, John Wiley & Sons, 2001. Reprint 2002.
2. **Signals and Systems**- Hsuetal Schaums Outline Series, TMH.

REFERENCE BOOKS:

1. **Signals and Systems Analysis of signals through linear systems**- Michel J Roberts, THM, 2003.
2. **Signals and Systems**- Alan V Oppenheim, Alan S. Willsky and S. Hamid Nawab- Pearson Education Asia, 2nd edition, 1997. Indian Reprint 2002.

TRANSMISSION AND DISTRIBUTION

Subject Code : **06EE53** 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- Standard voltages for transmission. Advantage of high voltage transmission. Feeders, distributors & service mains.

5 Hours

UNIT - 2

OVERHEAD TRANSMISSION LINES- sag calculation in conductors a) suspended on level supports b) support at different levels. Effect of wind & ice tension & sag at erection. Stringing chart

5 Hours

UNIT - 3

CORONA- Phenomena, expression for disputative & visual critical voltages & corona power loss

4 Hours

UNIT - 4

INSULATORS- Types, potential distribution over a string of suspension insulators. String efficiency & methods of increasing strings efficiency, testing of insulators.

6 Hours

UNIT - 5

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 - 6

Line parameters: calculation of inductance of single phase, 3phase lines with equilateral & unsymmetrical spacing. Inductance of composite conductor lines. Capacitance-calculation for two wires & three phase lines, capacitance calculation for two wire three-phase line with equilateral & unsymmetrical spacing.

10 Hours

UNIT - 7

Performance of power transmission lines- Short tr.-lines, medium tr.-lines, nominal T method, end condenser method, _ method and long transmission lines, ABCD constants of transmission lines, Power flow through lines, P-V & Q-V coupling.

10 Hours

UNIT - 8

Distribution- radial & ring main systems, ac to 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 (New Delhi)
2. **Electrical Power Systems**- C. L. Wadhwa Wiley Eastern.

REFERENCE BOOKS:

1. **Elements of Power System Analysis**- W.D. Stevenson, Mc. Graw - Hill. Comp. Ltd.
2. **Electric power generation Transmission & Distribution**- S. M. Singh, PHI, 2007.
3. **Transmission & Distribution Hand Book** - Westing House Corporation.
4. **Electrical Power-** Dr. S. L. Uppal, Khanna Publications
5. **Electrical Power-** J.B Gupta,

D.C. MACHINES AND SYNCHRONOUS MACHINES

Subject Code : **06EE54** 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-Classification of DC generator, types of armature winding, EMF equation, armature reaction, commutation, No load & load characteristics, use of interlopes & compensating winding (only qualitative treatment).

8 Hours

UNIT - 2

DC Motors- Classification, Back EMF equation, Torque equation, Characteristics of shunt, series & compound motors, speed control of shunt & series compound motors, losses in DC machines both generator and motor

9 Hours

UNIT - 3

LOSSES AND EFFICIENCY, direct & indirect methods of testing of DC machines, permanent magnet DC motors and brushless DC motors, applications of DC motors, Power flow diagram (all tests to be discussed).

9 Hours

PART - B

UNIT - 4

SYNCHRONOUS MACHINES- Basic principle of operation, construction of salient & non-salient pole synchronous machines, generated EMF, effect of distribution of winding and use of chorded coils.

4 Hours

UNIT - 5

VOLTAGE REGULATION: Voltage regulation by EMF, MMF, ZPF & ASA method

6 Hours

UNIT - 6

Synchronizing to infinite bus bars, parallel operation of alternators. Operating characteristics, power angle characteristics excluding armature resistance, operating for fixed input and variable excitation and vice-versa for both generating and motoring modes, V curves of synchronous machines, power flow equations including armature resistance, capability curves of synchronous generators hunting in synchronous machines, damper winding starting methods for hunting in synchronous machines.

12 Hours

UNIT - 7

Salient pole synchronous machines, two-reaction theory, power angle diagram, reluctance power, slip test

4 Hours

TEXT BOOKS:

1. **Performance & Design of Alternating Current machines**, M. G. Say, CBS publishers.
2. **Performance & Design of DC machines** A.E Clayton & Hancock ELBS Publication.
3. **Electrical Machines** Ashfaq Hussain, Dhanpat Rai Publications 2003 Edition.

REFERENCE BOOKS:

1. **Electrical machines**-Nagarath & DP Kothari, 2nd edition, TMH.
2. **Theory of alternating** -current machines. Alexander Langsdorf,
3. **Electrical machinery**- P.S Bhimbra, Khanna Publishers.

MODERN CONTROL THEORY

Subject Code : **06EE55** 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

STATE VARIABLE ANALYSIS AND DESIGN: Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations.

5 Hours

UNIT - 2

State space representation using physical variables, phase variables & canonical variables

5 Hours

UNIT - 3

Derivation of transfer function from state model, digitalization, 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 - 2nd edition, THM Hill 2003
2. **Control system Engineering-** I. J. Nagarath & M. Gopal, - 3rd edition, New Age International (P) Ltd.

REFERENCE BOOKS:

1. **State Space Analysis of Control Systems-** Katsuhiko Ogata - Prentice Hall Inc
2. **Automatic Control Systems-** Benjamin C. Kuo & Farid Golnaraghi, 8th edition, John Wiley & Sons 2003.
3. **Modern Control Engineering**- Katsuhiko Ogata- PHI 2003
4. **Control Engineering theory and practice-** M. N. Bandyapadhyay PHI, 2007
5. **Modern control systems**- Dorf & Bishop- Pearson education, 1998

LINEAR IC'S AND APPLICATIONS

Subject Code : **06EE56** 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 Zin capacitor coupled voltage follower, capacitor coupled non-inverting amplifier, high Zin capacitor coupled non-inverting amplifier, capacitor coupled inverting amplifier, setting upper cut off frequency, capacitor coupled difference amplifier, and use of single polarity supply.

8 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, Zin mod compensation, circuit stability precautions.

8 Hours

UNIT - 3

SIGNAL PROCESSING CIRCUITS: Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample &hold circuit.

6 Hours

UNIT - 4

OPAMPS AND NONLINEAR CIRCUITS: Op-amps in switching circuits, 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

6 Hours

UNIT - 6

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

6 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, -PHI 2008
2. **Operational amplifiers and linear** - Ramakanth A Gayakwad,-IC's Pearson, 4th edition, 2007.
3. **Operational amplifier and linear integrated circuits** - K.Lal kishore -Pearson education

REFERENCE BOOKS:

1. **Operational amplifiers and linear IC's**- Roy & Choudhry, - New age International
2. **Operational amplifiers and linear IC's-** Stanley William D, **-** 4th edition, Pearson Education.

CIRCUIT SIMULATION & MEASUREMENTS LAB

Subject Code : **06EEL57** 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. Determination of ratio & phase angle error in CT and PT.
6. Adjustment & calibration of 1-phase energy meter.
7. Measurement of active and reactive power in balanced 3-phase circuit using two-watt meter method.
8. a) Inverting, non-inverting & scale changing of signals using op –amps

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

TRANSFORMERS AND INDUCTION MACHINES LAB

Subject Code : **06EEL58** IA Marks : 25
No. of Practical Hrs./ Week : 03 Exam Hours : 03
Total No. of Practical Hrs. : 42 Exam Marks : 50

1. OC, SC test on 1- phase transformer: predetermination of efficiency & regulation. Experimental determination of Equivalent circuit constants and calculation of efficiency and regulation to be done to correlate results obtained earlier.
2. Sumpner's test.
3. Parallel operation of two dissimilar (different KVA) 1-phase transformers. Preferably the experiment to be conducted on two dissimilar transformers.
4. Polarity test & connection of 3 single phase transformers in star – delta and determination of efficiency & regulation – for balanced direct loading for UPF. Polarity test to be conducted on both AC and DC supply.
5. Scott connection- for balanced and unbalanced two phases UPF loads.
6. Load test on 3-phase induction motor- performance evaluation (Torque- speed, HP- efficiency, HP-PF, slip-HP).
7. Circle diagram of 3-phase induction Motor- performance evaluation.
8. Draw the equivalent circuit diagram of a 3-phase I.M after obtaining its circle diagram after conducting OC and SC test. from equivalent circuit, obtain the machine performance parameters.
9. Speed control of 3-phase induction motor by rotor resistance control only (for two different values of rotor resistance).
10. Load test on- induction generator.
11. Load test on 1 phase induction motor.
12. NL and SC test on 1-phase Induction motor.

VI SEMESTER SYLLABUS
Electrical & Electronics Engg

VI SEMESTER

POWER SYSTEM ANALYSIS AND STABILITY

Subject Code : **06EE61** 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, Transformer and load. One line diagram, impedance and reactance diagram. Per unit system, per unit impedance Diagram of power system, Y-bus by inspection method.

8 Hours

UNIT - 2

SYMMETRICAL 3 - PHASE FAULTS: Transients on a transmission line, Short-Circuit currents and the reactance of synchronous machines on load and on no load.

6 Hours

UNIT - 3 & 4

SYMMETRICAL COMPONENTS: 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.

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 & 8

STABILITY STUDIES: Steady state and transient stability. Rotor dynamics and the swing equation. Power angle equation for salient and non-salient pole machines, Equal area criterion for transient stability evaluation and its applications.

12 Hours

TEXT BOOKS:

1. **Elements of Power System Analysis**- W.D.Stevenson, -TMH,
2. **Modern Power System Analysis**-.I. J. Nagrath and D.P.Kothari- TMH, New Delhi

REFERENCE BOOKS:

1. **Power System Analysis**- Hadi Sadat- TMH
2. **Power system Analysis**- R.Bergen, and Vijay Vittal- Pearson publications, second edition.
3. **Computer Aided Power system analysis**- G.L., Kusic- PHI.
4. **Power System Analysis**- W.D.Stevenson & Grainger- TMH

SWITCHGEAR AND PROTECTION

Subject Code : **06EE62** 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: Isolating switch, load breaking switch, 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: Principles of AC Circuit breaking, Principles of DC Circuit breaking, problems encountered in DC breaking, Initiation of arc, maintenance of arc, Arc interruption – high resistance and low resistance interruption, Arc interruption theories – slepian's theory and energy balance theory, Re striking voltage, recovery voltage, Rate of rise of Re striking voltage, 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 SF6 breaker - Preparation of SF6 gas, Puffer and non Puffer type of SF6 breakers. **VACUUM CIRCUIT BREAKERS -** Construction, principle of operation, advantages and disadvantages of different types of Circuit breakers, Testing of Circuit breakers, Unit testing, synthetic testing short circuit test lay out

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.
2. **Power System Protection & Switchgear**- Badriram & Viswa Kharma -TMH.
3. **Fundamentals of Power System protection**- Y G. Painthankar and S R Bhide-PHI publication, 2007.

REFERENCE BOOKS:

1. **A Course in Electrical Power**- Soni, Gupta & Bhatnagar- Dhanapatirai. Publication -

2. **Power System Protection & Switchgear**- Ravindarnath & Chandra -New age Publications.
3. **Electrical Power-** Dr S. L. Uppal- Khanna Publishers.

ELECTRICAL MACHINE DESIGN

Subject Code : **06EE63** 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, commutators and brushes, magnetic circuit - estimation of ampere turns, design of yoke and pole, 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 transformer, 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 cross sectional area of Primary and secondary coils, 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, leakage reactance, and circle diagram

14 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
2. **Design Of Electrical Machines**- V. N. Mittle- 4/e edition

REFERENCE BOOKS:

1. **Performance And Design Of AC Machine**s- M.G.Say
2. **Principles Of Electrical Machine Design-** R.K.Aggarwal
3. **Design Data Handbook-** Sanmug Sundarm

DIGITAL SIGNAL PROCESSING

Subject Code : **06EE64** 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

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

12 Hours

UNIT - 3

FAST FOURIER TRANSFORMS ALGORITHMS: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplication, computational efficiency, decimation in frequency algorithms, decomposition for 'N<=9' a composite number inverse FFT.

8 Hours

UNIT - 4

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

8 Hours

PART - B

UNIT - 5

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 - 6

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

8 Hours

UNIT - 7

DSP PROCESSORS TMS FAMILY: Architecture & features, modes and architecture.

4 Hours

TEXT BOOKS:

1. **Digital Signal Processing Principle,** Algorithm & application- Proakis, -Pearson education/PHI
2. **Introduction To Digital Signal Processing**- Johnny R. Johnson- PHI
3. **Digital Signal Processing**- Li – Tan - Ist edition, Elsevier, 2008
4. **Digital Signal Processing-** Sanjeet. K. Mitra –TMH

REFERENCE BOOKS:

1. **Discrete Time Signal Processing** – Openheim – person education/PHI
2. **Digital Signal Processing-** Salivatanan Vallarajgnanpriya-TMH.
3. **Digital Signal Processing**- Ifeachor Emmauel- Pearson education.
4. **Digital Signal Processing**- Steven .W. Smith -Elsevier, 2006.

ELECTRICAL DRAWING AND CAD

Subject Code : **06EE65** IA Marks : 25
No. of Lecture Hrs./ Week : 04 Exam Hours : 03
Total No. of Lecture Hrs. : 52 Exam Marks : 100

PART - A

1) Single Line Diagrams of generating stations and substations, layout of power plants – Hydel, Thermal & Nuclear.

6 Hours

2) Electrical Machine Assembly Drawing using Design Data and sketches
a) Transformer: Assembly and Sectional views of single phase and three phase Core and Shell Types. b) DC Machine: Assembly and Sectional views of yoke, field systems, armature and commutator of DC machine dealt separately.
c) Alternator: Assembly and Sectional views of Stator and Rotor dealt separately

20 Hours

PART - B

3) Winding Diagram:
a) Developed Winding Diagram for DC machines: Simplex and duplex, Lap and Wave Single and Double Layer.
b) Developed winding diagram for AC machines:
c) Integral slot single layer and double layer full-pitched lap and wave winding.
d) Integral slot single layer and double layer fractional pitched lap and wave winding. Fractional slot lap and wave winding

14 Hours

4) Study of auto CAD graphics package. Exercises on computer aided electrical drawing - single line diagram for a typical substation, simplex single layer, lap and wave DC armature winding, sectional views of single-phase core type transformer.

12 Hours

TEXT BOOKS:

1. **Electrical Drafting -**Devalapur, S. F., Eastern Book Promoters, Belgaum, 2006.
2. **Electrical Engineering Drawing -**Bhattacharya, S. K., Wiley Eastern Ltd (Part A).
3. **Introduction to Auto CAD 2000-**Mark Dix Paul Riley, Pearson Education.

REFERENCE BOOKS:

1. **Electrical Engineering Drawing -**Naranga, K. L., Satya Prakashan, ND Publications.
2. **Principles of Interactive Computer Graphics -**Newman, and Sporule, TMH Publishers.
3. **Teach yourself Auto- CAD –**Gibbs.
4. **Auto-CAD -**Cohn, TMH.

ELECTIVE-I (GROUP A)
NETWORK SYNTHESIS & ACTIVE FILTER DESIGN

Subject Code : **06EE661** 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 & 3

ELEMENTS OF PASSIVE NETWORK SYNTHESIS: Hurwitz polynomials, LC admittances, LC ladders, realization & Foster test for Hurwitz, LC- RC transformation and RC synthesis, L ladder N/W & its transmission poles, transmission zeros of LC&RC ladders dual of ladder network & OF RC ladder, positive real functions, synthesis of RLC N/W by Darlington method, determination of driving point impedance from its real part.

18 Hours

UNIT - 4

IMAGE IMPEDANCE: Image impedances, L sections- Relation to symmetrical T and _ networks, propagation constant for iterative networks, propagation constant for image terminated networks

9 Hours

PART - B

UNIT - 5

CLASSICAL FITTERS: classical filters & low pass prototype, m derived filters, impedance & frequency scaling frequency transformation: high pass & band pass filters

9 Hours

UNIT - 6, 7 & 8

MODERN FILTER THEORY & ACTIVE RC FILTERS:

Approximation to ideal LP filter, maximally flat magnitude function, Butterworth functions & synthesis, chebychev's filter, operations using OPAMP configuration, Active RC networks, and low pass active filters, GCCG transformations, parameter variations & sensitivity consideration for active RC circuits

16 Hours

TEXT BOOKS:

1. **Introduction to Modern Network Synthesis** - E. V. Vanvalkenburg, Wiley Eastern ltd.
2. **Network Analysis & Synthesis** - Franklin.F .Kuo 2/e Wiley International Edition.

REFERENCE BOOKS:

1. **Networks & Systems** -- D. Roy Choudhury, new age international.
2. **Circuit Theory** - TSKV Iyer 1996, Tata McGraw-Hill publications.
3. **Analog Signal Processing With Laplace Transform & Active Filter Design**, Meador, Thomson learning.
4. **Analog Filter Design** by Vanvalkenberg

ADVANCED POWER ELECTRONICS

Subject Code : **06EE662** 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 inverter, 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

6 Hours

UNIT - 6, 7 & 8

HIGH FREQUENCY INDUCTOR AND TRANSFORMERS: Design principles, definitions, comparison with conventional design and problems.

10 Hours

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-** converters, application & design**-** Mohan N, Undeland T.M., Robins, W.P-John Wiley 1989
2. **Power Electronics-Circuits, Devices,** Applications**-** Rashid M.H.- 3rd Edition, Prentice Hall India, 2008.
3. **Power Electronics and A.C. Drives-** Bose B.K.-Prentice Hail 1986.
4. **Digital Power Electronics And Applications-** Muhammad Rashid. first edition, 2005, Elsevier.

ELECTRONIC INSTRUMENTATION

Subject Code : **06EE663** 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, Performance, characteristics, static characteristics, error in measurement, source of error, type of error, dynamic characteristics.

4 Hours

UNIT - 2

Transistor voltmeter, micro voltmeter, solid state voltmeter, Differential v voltmeters, RMS voltmeter, RMS meter, Ohm meter, multimeter, Digital voltmeter, Dual slope integrating type and integrating type DBM.

8 Hours

UNIT - 3

Digital voltmeter, frequency meter, measurement of time, frequency digital tachometer, phase meter, capacitance meter, and µP based instruments.

8 Hours

UNIT - 4

Strip chart recorder, galvanometer type, null type circulars, chart recorder, xy recorder

6 Hours

PART - B

UNIT - 5

Fixed frequency AF Oscillator, Variable AFO, standard signal generator, AF Sine & square wave generator, function generator, and square & pulse generator.

8 Hours

UNIT - 6

Output power meters, field strength meter, stroboscope phase meter, direct reading impedance meters, Q meter, LC or bridge R X meters, automatic bridges, transistor tester, and megger.

8 Hours

UNIT - 7

Electrical transducers, differential output transducers, LVDT, pressure inductive transducers, capacitive transducers.

6 Hours

UNIT - 8

Digital display system and indicators, classification of displays, display devices, LEDs, LCDs and other displays.

4 Hours

TEXT BOOKS:

1. **Electronic Instrumentation-** H.S.Kalsi-Tata McGraw-Hill Publishing Company Limited. New Delhi, 9th reprint 2000

2. **Modern Electronic Instrumentation & Measurement Technique**- D. Heifric, William. D. Cooper - PHI

REFERENCE BOOKS:

1. **Elements of Electronic Instrumentations & Measurement-** Carr Joseph - 3/e Pearson Education.

2. **Electronic Instrumentations**- - BELL, PHI publications.

INTELLECTUAL PROPERTY RIGHTS

Subject Code : **06EE664** 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

BASIC PRINCIPLES OF IPR LAWS: Introduction, concept of property, Mar'x theory of property, constitutional aspects of intellectual property, Basic principles of patent laws ; Historical background in UK, US and India Basis for IP Protection, Criteria for patentability; Novelty Utility and Inventive step, Non – obviousness, Non patentable invention.

12 Hours

UNIT - 3 & 4

PATENT APPLICATIONS PROCEDURE AND DRAFTING: Specification, priority date publication of application, Examination of application, opposition of gratis and sealing of patents, patent specification, kinds of patent specifications parts of the complete specifications Claims Patentable aspects of the invention to be considered in the specification, Novelty inventiveness manner of manufacture utility and usefulness of invention restriction on patentability case studies.

12 Hours

PART - B

UNIT - 5

UNDERSTANDING COPYRIGHT LAW: Evolution of copyright law in India, Justifications. Subject matter of copyright, Terms of protection, concepts – originality/novelty idea expression, fixation and fair use, Copyrights in software protection, infringement of copyright and acquisition in Indian context.

10 Hours

UNIT - 6

TRADE MARK: Introduction, Justification, concepts subject matter acquisition Implication and benefit of registration Terms of protection Geographical indication of goods Infringements of trademark

8 Hours

UNIT - 7 & 8

INDUSTRIAL DESIGN: Introduction, Justification, Subject matter of design law Definition, Excluded subject matter Law relating to industrial design and registration in India, Infringement of design rights semiconductor topography design rights

10 Hours

TEXT BOOKS:

1. **Basic Principles and Acquisition of IPR-** T Ramakrishna-CIPRA NLSIU, Bangalore 2003.
2. **Ownership And Enforcement Of Intellectual Property Rights**- T Ramakrishna,- CIPRA NLSIU Bangalore 2003.
3. **Law Relating To Patents, Trademark, Design, Geographical Indicators**- Wadhera BL- Universal Law Press 2000.

REFERENCE BOOKS:

1. **Intellectual property law**- P Narayan- 3rd edition, Estern Law House, 2001
2. **Intellectual property-** David Bainbridge- 5th edition, Indian reprint 2003, Pearson Education.
3. **World Intellectual Property Organizations** (WIPO) Handbook/ Notes

OBJECTED ORIENTED PROGRAMMING USING C++

Subject Code : **06EE665** 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.

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 <<, overloading the input 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, 3rd edition, 2007.
2. **C++, The Complete Reference -**Herbert Schildt**,** , TMH, 3rd edition
3. **Standard C++**- 2nd edition, Thomson Learning, Vikas Publishing House.

REFERENCE BOOKS:
1. **"The C++ programming language"-**Bjarne Stroustrup, Pearson Education, 3rd edition.
2. **"Objected oriented programming with C++"-**Bhave, Pearson Education.

FUZZY LOGIC

Subject Code : **06EE666** 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 & 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.

20 Hours

PART - B

UNIT - 5 & 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, etc).

12 Hours

UNIT - 7 & 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. **An Introduction to Fuzzy Control**- D. Diankar, H. Hellendoom and M. Reinfrank- Narosa Publishers India, 1996.
2. **Fuzzy Sets Uncertainty and Information**- G. J. Klir and T. A. Folger- PHI IEEE, 1995.

REFERENCE BOOKS:
1. **Essentials of Fuzzy Modeling and Control**- R. R. Yaser and D. P. Filer -John Wiley, 1994.
2. **Fuzzy Logic With Engineering Applications-** Timoty Ross,- McGraw Hill.
3. **Fuzzy Logic Intelligence Control And Information-** Yen- Pearson education.

ARTIFICIAL NEURAL NETWORK

Subject Code : **06EE667** 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 multiplayer 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. **Neural Network Design**- Hagan, Demuth and Beale- Thomson learning, 1996.

REFERENCE BOOKS:

1. **Artificial Neural Networks**- R, Schalkoff, - McGraw Hill, 1997.
2. **Introduction To Artificial Neural Systems**- J. Zurada,- Jaico, 2003
3. **Neural Networks -**Haykins, PHI, 1999. Hertz, Krogh, Palmer, Introduction to theory of neural computation, Addison Wesley, 1991.

DC MACHINE AND SYNCHRONOUS MACHINES LAB

Subject Code : **06EEL67** 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. 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 Hpefficiency characteristics.
3. Swinburne's Test.
4. Hopkinson's Test.
5. Fields 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.
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.

CONTROL SYSTEMS LABORATORY

Subject Code : **06EEL68** IA Marks : 25
No. of Practical Hrs./ Week : 03 Exam Hours : 03
Total No. of Practical Hrs. : 42 Exam Marks : 50

1. Simulation of a typical second order system and determination of step response and evaluation of time- domain specifications
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 the frequency response of a second -order system and evaluation of frequency domain specifications.
8. Simulate a D. C. position control system using MATLAB/SCILAB and obtain its step response.
9. Obtain the phase margin and gain margin for a given transfer function by drawing bode plots. Verify the same using (i) MATLAB/SCILAB and
(ii) The rltool command of MATLAB or equivalent in SCILAB.
10. (a) To draw the root loci for a given transfer function and verification of breakaway point and imaginary axis crossover point using (i) MATLAB/SCILAB (ii) The rltool command of MATLAB or equivalent in SCILAB (b) To draw the Nyquist plot for a given transfer function using MATLAB/SCILAB.
11. To draw and study syncro pair characteristics.

VII SEMESTER SYLLABUS
Electrical & Electronics Engg

VII SEMESTER
COMPUTER TECHNIQUES IN POWER SYSTEM ANALYSIS

Subject Code : **06EE71**	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), by method of singular transformation ($Y_{BUS} = A_T y A$); 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 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 El-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, 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, New Delhi, 1984.
4. **Power System Analysis-** Haadi Sadat, -TMH, 2nd , 12th reprint, 2007

ELECTRICAL POWER UTILIZATION

Subject Code : **06EE72** 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 device and welding equipment

10 Hours

UNIT - 2

ELECTROLYTIC PROCESS: Fundamental principles, extraction, refining of metals, 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 and CFL and their working, Glare and its remedy

10 Hours

PART - B

UNIT - 5, 6 & 7

ELECTRIC TRACTION: System of traction, speed time curve, tractive effort at /co-efficient of adhesions, 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, train lighting system, specific energy, factors affecting specific energy consumption.

20 Hours

UNIT - 8

INTRODUCTION 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-** Openshaw Taylor
2. **Modern Electric, Hybrid Electric and Fuel Cell Vechiles**- 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.
2. **Electrical Power** by Dr. S.L.Uppal Khanna Publications

HIGH VOLTAGE ENGINEERING

Subject Code : **06EE73** 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, advantages of transmitting electrical power at high votages, need for generating high voltages in laboratory. Important applications of high voltage.

4 Hours

UNIT - 2 & 3

BREAKDOWN PHENOMENA: Classification of HV insulating media. Properties of important HV insulating media under each category. Gaseous dielectrics: Ionizations: 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 gasses. 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 liquids dielectric 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. Triggering 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 voltmeterprinciple, 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. Surge current measurement-Klydanograph and magnetic links.

12 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 Fundamentals**- E. Kuffel and W.S. Zaengl- 2nd edition, Elsevier, press, 2005.
2. **High Voltage Engineering**- M.S.Naidu and Kamaraju- 3rd Edition, THM, 2007.
3. **High Voltage Engineering** -C.L.Wadhwa, New Age International Private limited, 1995.

REFERENCE BOOKS:

1. **Extra High Voltage AC Transmission Engineering -**Rakosh Das Begamudre, Wiley Eastern limited, 1987.

2. **Transmission and Distribution Reference Book**-Westing House.
3. **High Voltage Technology**- L. L. Alston- BSB Publication, 2007.

INDUSTRIAL DRIVES & APPLICATIONS

Subject Code : **06EE74** 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 dc separately excited motor, Single-phase half controlled rectifier control of dc separately excited motor.

(b) Three phase fully controlled rectifier control of dc separately excited motor, three phase half controlled controlled rectifier control of dc separately excited motor, multiquadrant operation of dc separately excited motor fed form fully controlled rectifier. Rectifier control of dc series motor, chopper controlled dc drives, chopper chopper control of separately excited dc motor. Chopper control of series motor.

12 Hours

PART - B

UNIT - 5 & 6

INDUCTION MOTOR DRIVES:

(a) Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from nonsinusoidal voltage supply, starting braking, transient analysis. **(b)** Stator voltage control variable voltage frequency control from voltage sources , voltage source inverter control, closed loop control, current source inverter control, current regulated voltage source inverter control, rotor resistance control, slip power recovery, speed control of single phase induction motors.

12 Hours

UNIT - 7

SYNCHRONOUS MOTOR DRIVES: Operation form faced frequency supply, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thruster inverter.

10 Hours

UNIT - 8

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

4 Hours

TEXT BOOK:

1. **Fundamentals of Electrical Drives**"- G.K Dubey -2 Edition, 5th reprint Narosa publishing house Chennai, 2002.

REFERENCE BOOKS:

1. **Electrical Drives**- N.K De and P.K. Sen- PHI, 2007
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.

ELECTIVE-II (GROUP B)

POWER SYSTEM PLANNING

Subject Code : **06EE751** 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

OVER VOLTAGES IN POWER SYSTEM

Subject Code : **06EE752** 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

Introduction to over voltages phenomenon in power system: transient on transmission lines: infinite line definition and its transient behavior, finite line analyses, analysis for different line terminations, problems. Bewely lattice diagram, problems.

15 Hours

UNIT - 3 & 4

Use of transients network analyzer, digital and hybrid computers for solving large scale problems, characteristics of lightning discharges, theory of cloud formation origin of lightning, iso-Keronic level, leader development, return stroke, different types of lightning interaction, back flash over

11 Hours

PART - B

UNIT - 5 & 6

Shielding angle calculation for line, grounding rods, counter poise, problems, origin and characteristics of switching over voltages and temporary over voltages, problems of switching surges.

11 Hours

UNIT - 7 & 8

Behavior of apparatus and line insulation under all types of over voltages, concept of BIL, protection of apparatus against over voltages, surge arresters, insulation co-ordination

15 Hours

TEXT BOOK:

1. **"Power System Transients"-**Greenwood, , Orient Longman 1987 **REFERENCE BOOKS:**
1. **Extra High Voltage AC Transmission Engineering -**Rakesh Das Begamudre, Willey Eastern Limited. 1987
2. **"High Voltage Engineering Fundamentals"** E.Kuffel and W.S.Zaengal, and J. Kuffel 2nd Edition, Elsevier, 2005.
3. **High Voltage Engineering -**M.S.Naidu and V.Kamaraju, 3rd Edition, TMH, 2007.
4. **"High Voltage Engineering" -**R. S. Jha "High Voltage Engineering", Khanna publishers
5. **"High Voltage Engineering"-** C.L.Wadhwa, New age international

TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT

Subject Code : **06EE753** 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,
2. **Testing & Commissioning Of Electrical Equipment** -B .V. S. Rao,

REFERENCE BOOKS:

1. Relevant Bureau of Indian Standards
2. **"A Handbook on Operation and Maintenance of Transformers"-**H. N. S. Gowda,
3. **Transformer & Switch Gear Handbook** -Transformers-BHEL, J &P, J & P

ELECTERICAL ENGINEERING MATERIALS

Subject Code : **06EE754** 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; 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: Dielectrics 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, Magnetosrtictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels

6 Hours

UNIT - 8

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

8Hours

TEXT BOOKS:

1. **"An Introduction to Electrical Engineering"-** Indulkar C.S. & Thiruvengadam. S.
2. **"Electrical Engineering Materials"-**Yu Koritsky, MIR
3. **"Materials Science for Electrical & Electronics Engineering"**- Ian P.Jones. Oxford University Press,2007
4. **"Materials Science"-**Arumugam M, Anuradha Publishers, 1990
5. **"Applied Solar Energy"**-An Introduction -Meinal A.B Meinal M
P, – An Introduction., Addison Wesley Publications,
6. **"Electrical Engineering Materials"-**Kapoor P L., Khanna Publications.

DIGITAL SYSTEM DESIGN USING VHDL

Subject Code : **06EE755** 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.

7 Hours

UNIT - 2

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

6 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.

6 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: Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 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.

7 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,-** Thomson Learning **-** Charles H. Roth. Jr: Inc, 2002.
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, Tata McGraw-Hill, New Delhi, 2003
2. **Digital Fundamentals using VHDL -**Floyd, Pearson Education, 2003,
3. **VHDL Primer**, -J. Bhaskar Pearson / PHI, NewDelhi, 2003

EMBEDDED SYSTEMS

Subject Code : **06EE756** 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.

12 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.

12 Hours

TEXT BOOKS:

1. **"Embedded Microcomputer systems : Real time interfacing"-** Valvano, J.W, Brooks/Cole, 2000
2. "**The Art of Designing Embedded systems**"- Ganssle, Jack, Newness
3. **"Embedded System, Architecture, Programming and Design"-** Raj Kamal TMH 2003.

REFERENCE BOOKS:

1. **"A Unified Hardware/Software Introduction"-**Frank Vahid/Tony Givargis, Wiely student edition 2002
2. **Motorola and Intel Manuals**

RELIABILITY ENGINEERING

Subject Code : **06EE757** 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: Concept of reliability, reliability indices, component reliability –Introduction, non repairable component, hazard models, components with preventive maintenance, repairable components.

8 Hours

UNIT - 2

SYSTEM RELIABILITY: network methods, Introduction; series configuration parallel configuration, mixed configuration, the r out of n configuration d composition method minimal-tie and minimal –cut methods logic diagrams.

8 Hours

UNIT - 3 & 4

System reliability state space method system representation basic concepts state probability state frequency and duration system of two independent component two components with dependent failures combining states failure effect analysis state enumeration methods

10 Hours

PART - B

UNIT - 5

System reliability other methods dependent failure models for non repairable components fault tree analysis monte- carlo simulation

8 Hours

UNIT - 6 & 7

Basic probability theory probability concepts permutation and combination practical engineering concepts venn diagram rules for combining probabilities, probability distribution random variables density and distribution

10 Hours

UNIT - 8

System reliability evaluation using probability distribution series system parallel system partially redundant system mean time to failure stand by system

8 Hours

TEXT BOOKS:

1. **"Concepts in reliability engineering"-** L S Srinath, East West Press Ltd, 2nd edition.
2. **"Reliability modeling in electrical power system"-** J. Endrenyi, John Wiley & Sons

REFERENCE BOOK:

1. **"Reliability Evaluation of Engineering Systems"-** Roy Billintan & Ronald. N. Allar, 2nd Edition, 1992.

ELECTIVE-III (GROUP C)

REACTIVE POWER MANAGEMENT

Subject Code : **06EE761** 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.

8 Hours

UNIT - 2 & 3

Load compensation, objectives, practical considerations, Transmission line compensation: types, passive/active, Fixed/ regulated series/shunt compensation, compensation by sectioning.

10 Hours

UNIT - 4

Static Compensator and synchronous condensers

8 Hours

PART - B

UNIT - 5 & 6

Harmonics effects, resonance, shunt capacitors and filters

10 Hours

UNIT - 7

Telephone interferences

8 Hours

UNIT - 8

Reactive power coordination, reactive power management, transmission benefits, reactive power dispatch & equipment impact

8 Hours

TEXT BOOKS:

1. **"Reactive power control in electric power systems"-** T. J. E. Miler, John Wiley & Sons NY 1982.
2. **"Power Generation Operating & Control"-** A J Wood & B.F Woolenberg, John Wiley & Sons 1984.

REFERENCE BOOK:

1. IEEE "**Guide on Harmonic control & reactive compensation of power converters'** IEEE student 519-1981.

MICRO ELECTRO MECHANICAL SYSTEMS

Subject Code : **06EE762** 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 MEMS TECHNOLOGY: Introduction to MEMS and motivation, Basic definitions, history of **SCALING IN MICRODOMAIN:** How small is different- some natural examples, Scaling laws in electrostatic, electromagnetic, rigidity of structures, heating & cooling, Fluid viscosity and fluid interfaces, etc. Scaling in overall system performance considering multiple physical domains

7 Hours

UNIT - 2

MEMS MATERIALS: Mechanical and other properties of materials used in MEMS**MICROFABRICATION / MICROMACHINING:** Overview of microfabrication, Review of

microelectronics fabrication processes like photolithography, deposition, doping, etching, structural and sacrificial materials, other lithography methods,. MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.

9 Hours

UNIT - 3 & 4

TRANSDUCTION PRINCIPLES: Transduction principles in microdomain **MEMS MODELING:** Basic modeling elements in electrical, mechanical, thermal and fluid systems, analogy between 2nd order mechanical and electrical systems. Modeling elastic, electrostatic, electromagnetic systems.

10 Hours

PART - B

UNIT - 5

RADIO FREQUENCY (RF) MEMS: Introduction, Review of RF-based communication systems, RF –MEMS like MEMS inductors, varactors, tuners, filters, resonators, phase shifters, switches

7 Hours

UNIT - 6

OPTICAL MEMS: Preview, passive optical components like lenses and mirrors, actuators for active optical MEMS.

5 Hours

UNIT - 7 & 8

CASE STUDIES: Case studies of microsystems including microcantilever based sensors and actuators with appropriate selection of material properties: thermal; mechanical properties. Static and dynamic mechanical response with different force mechanisms: electrostatic, electromagnetic, thermal etc. Tutorials: The above case study examples are to be implemented in either CoventorWare or ANSYS Multiphysics.

NANOTECHNOLOGY AND MEMS: Relation between micro and nanotechnologies. Need and issues in handling nano products with the help of MEMS

14 Hours

REFERENCE BOOKS:

1. **"MEMS and Microsystems Design and Manufacture"**-Tai, Ran Hsu, TMH, 2002, ISBN 0-07-239391-2.
2. **"Foundations of MEMS"-** Chang Liu, Pearson International Edition, 2006, ISBN 0-13-199204-X
3. **"Modeling MEMS and NEMS"-** John A. Pelesko, David H. Bernstein, Chapman & Hall/CRC, 2003, ISBN 1-58488-306-5
4. **"MEMS"**-Nitaigour Premchand Mahalik, TMH, 2007, ISBN 13:978-0-07-063445-9
5. **"The Science and Engineering of Microelectronic Fabrication"**- Second Edition, Campbell, Oxford, 2001, ISBN 0-19-513605-5. (General Microfabrication Reference.)
6. **"Fundamentals of Microfabrication"** - Madou, CRC Press, 1997, ISBN 0-8493-9451-1. (Microfabrication for MEMS + some information on materials and devices.)
7. **"Micromachined Transducers Sourcebook"**-Kovacs, McGraw- Hill, 1998, ISBN 0-07-290722-3. (General MEMS reference with an emphasis on a very large number of transduction methods.)
8. **"An Introduction to Microelectromechanical Systems Engineering"**- Nadim Maluf, Artech House, 2000
9. **"Introduction to Microelectromechanical** "(MEM) Microwave Systems H.J. De Los Santos, Artech, 1999.
10. **"Smart Sensors and MEMS"**- Edtd. By Sergey Y. Yurish, Maria Teresa, S R Gomes, Nato Science Series-Kluwer Academic Publishers, London, 20.

ENERGY AUDITING AND DEMAND SIDE MANAGEMENT

Subject Code : **06EE763** 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.

4 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, multiutility 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 distribution**, Pabla TMH, 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.
3. **"Demand Side Management"-**Jyothi Prakash, TMH Publishers.
4. **Hand book on energy auditing** - TERI (Tata Energy Research Institute)

INSULATION ENGINEERING

Subject Code : **06EE764** 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 Multidielectric system.

7 Hours

UNIT - 2

INSULATION SYSTEM IN POWER SYSTEM APPARATUS: Insulation system in capacitors, bushings, and transformers modes of failure of insulation systems. Insulation 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.

9 Hours

UNIT - 6

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

9 Hours

UNIT - 7

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

8 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, 1974.
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 gass"-** 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, 3rd edition, TMH, 2007.

DISCRETE CONTROL SYSTEM

Subject Code : **06EE765** 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

Z-PLANE ANALYSIS OF DISCRETE-TIME CONTROL SYSTEMS: Impulse Sampling and data Hold, obtaining the Z-transform by convolution integral method, reconstruction the original signals from sampled signals, the pulse transfer function, realization of digital controllers and digital filters

10 Hours

UNIT - 3 & 4

DESIGN OF DISCRETE TIME CONTROL SYSTEMS BY CONVOLUTION METHODS: Mapping between the s-plane and the zplane, stability analysis of closed loop systems in the z-plane, transient and steady state response analysis design based on the root locus method, design based on frequency response method, analytical design method.

16 Hours

PART - B

UNIT - 5 & 6

STATE SPACE ANALYSIS: State space representation of discrete time systems, solution of discrete time state space equations, pulse transfer functions matrix, discretization of continuous time state space equations, Liapunov stability analysis.

12 Hours

UNIT - 7 & 8

POLE PLACEMENT AND OBSERVER DESIGN: Controllability, observability, useful transformations in state space analysis and design, design via pole placement, state observers, and servo systems.

14 Hours

TEXT BOOK:

1. **"Discrete-Time Control Systems"**-Kutsuhiko Ogata, 2nd Edition, Pearson Education, 2003.

REFERENCE BOOKS:

1. **"Digital Control and State Variable Methods"-**M. Gopal, 2nd Edition, TMH, 2007.
2. **"Modern Control System"-** Richard C. Dorf, Robert H. Bishop, 11th Edition Pearson Education, 2008.
3. **"Discrete Control Systems"-**John F. Dorsey, TMH.
4. **"Digital Control System"-** Moudalya, K.M., John Wiley & Sons, 2007

VLSI CIRCUITS AND DESIGN

Subject Code : **06EE766** 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 MICROELECTRONIC 3 AND AN INTRODUCTION TO MOS TECHNOLOGY: Introduction to integrated circuit technology, Production of E-beam masks. Introduction, VLSI technologies, MOS transistors, fabrication, thermal aspects, production of E-beam masks.

6 Hours

UNIT - 2

BASIC ELECTRICAL PROPERTIES OF MOS AN BICMOS CIRCUIT: Rain to source current Ids versus Vds relationships-BICMOS latch up susceptibility. MOS transistor characteristics, figure of merit, pass transistor NMOS and COMS inverters, circuit model, latch up.

8 Hours

UNIT - 3

MOS AND BICMOS CIRCUIT DESIGN PROCESSES: Mass layers, strick 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- Limit due to current density.

8 Hours

UNIT - 6

SUBSYSTEM DESIGN AND LAYOUT: Some architecture issues- other systems considerations. Examples of structural design, clocked sequential circuits

8 Hours

UNIT - 7

SUBSYSTEM DESIGN PROCESSES: Some general considerations, an 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, implementing ALU functions.

4 Hours

TEXT BOOKS:

1. **"Basic VLSI Design" -3rd** Edition, PHI
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"-**Wayne wolf 2003.

OPERATING SYSTEMS

Subject Code : **06EE767** 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 SYSTEMS AND THEIR CLASSIFICATIONS: What is an operating system, Main frame systems, Desktop systems, Multiprocessor system, Distributed system, Clustered system, Real time system, Hand held system, Feature migration, Computing environments.

5 Hours

UNIT - 2

OPERATING SYSTEM STRUCTURES: System components, OS services, System calls, System programs, System structure, Virtual machines.

3 Hours

UNIT - 3

PROCESS, INTER PROCESS COMMUNICATION, THREADS & CPU SCHEDULING: Process concept, Process scheduling, Operation on processes, Co-operating processes, Inter Process communication. Threads – Overview, Multithreading models, Threading issues, P threads, Java threads. CPU Scheduling – Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor Scheduling, Real time Scheduling.

8 Hours

UNIT - 4

PROCESS SYNCHRONIZATION AND HANDLING DEADLOCKS: The critical section problem, Synchronization hardware, Semaphores, Classical problems of Synchronization, Critical regions, Monitors. Deadlock- System model, Dead lock characterization, Methods for handling Dead

locks- Deadlock prevention, dead lock avoidance, Dead lock detection and recovery from deadlock.

10 Hours

PART - B

UNIT - 5

STORAGE MANAGEMENT: Main memory management – Background, Swapping, Contiguous allocations, Paging, Segmentation, Segmentation with paging.

5 Hours

UNIT - 6

VIRTUAL MEMORY – Background, Demand paging, Process creation, Page replacement algorithms, Allocation of frames, Thrashing.

5 Hours

UNIT - 7

FILE SYSTEM INTERFACE - File concept, Access methods, Directory structure, File system mounting, File system implementation, Directory implementation, Allocation methods, free space management.

5 Hours

PROTECTION AND SECURITY: Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, The security problem, Authentication, Program threats, System threats, Securing systems and facilities, Intrusion detection, Cryptography.

4 Hours

UNIT - 8

INTRODUCTION TO DISTRIBUTED OPERATING SYSTEMS: Background, Topology, Network types, Communication, Co-protocols, Robustness, design issues.

4 Hours

CASE STUDY- LINUX OPERATING SYSTEM: Design principles, Kernel modules, Process management, Memory management, and File systems, Input and Output, Communication.

3 Hours

TEXT BOOK:

1. **"Operating System Concepts"-**Abraham Silberschatz, Peter Baer Galvin, Greg Gagne 6th Edition, Wiley Indian Edition, reprint 2007.

REFERENCES BOOKS:

1. **"Operating System Concepts and design"-** 2nd edition, Milan Milankovic McGrawhill 1992.
2. **"Operating system"**- Harvey M Deital, Addison Wesley 1990.
3. **Operating System** –A Concept Based Approch – D.M.Dhamdhere.TMH,2002.
4. **Godbole Operating System Concepts** –Achyut's

RELAY AND HIGH VOLTAGE LAB

Subject Code : **06EEL77** IA Marks : 25
No. of Practical Hrs./ Week : 03 Exam Hours : 03
Total No. of Practical Hrs. : 42 Exam Marks : 50

(Total 10 experiments are to be conducted)

PART - A

(Choose at least two experiments)

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 stare 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 stare or electromechanical type).
4. Operation of negative sequence relay.
5. Bias characteristics of differential relay.
6. Current-time characteristics of fuse.

PART - B

(Choose at least one experiment)

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

(Choose at least one experiment)

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

PART - D

(Choose at least two experiments)

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.

POWER SYSTEM SIMULATION LAB

Subject Code : **06EEL78** 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 ++ Sie lab /octave
1. a) Y Bus formation for p 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 2-bus, using 2-bus build Algorithm without mutual.

3. ABCD parameters: Formation for symmetric II/I configuration. Verification of AD-BC=1 Determination of coefficient and regulation
4. Determination of power angle diagrams for salient and non-salient pole synchronous m/c s, reluctance power, excitation, emf and regulation.
5. To determine I) Swing curve II) critical clearing time for a single m/c for connected to infinity bus through a pair of identical transmission lines, 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 Gaus- Seidel method (only p q bus)
8. To determine fault currents and voltages in a single transmission line systems with star-delta transformers at a specified location for SLGF, DLGF.
9. Load flow analysis using Gauss Siedel method, NR method, Fast decoupled flow method for both pq and pv buses.
10. Optimal Generator Scheduling for Thermal power plants.

Note: 1,2,3,5,7… Simulation Experiments using MATLAB/C or C++/Sielab/Octave
4,6,9-use suitable Standard Package

VIII SEMESTER SYLLABUS

Electrical & Electronics Engg

VIII SEMESTER

INDUSTRIAL MANAGEMENT, ELECTRICAL ESTIMATION & ECONOMICS

Subject Code : **06EE81** 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: Historical prospective, contribution of Taylor, Henry foyol, Gilberth and HL Gnatt to the evolution of management as a scientific discipline concept of scientific management and it relevance in the Indian context.

5 Hours

ORGANIZATION: Types of organization; their merits and demerits

4 Hours

UNIT - 2

MANAGEMENT FUNCTIONS: Planning, organizing, staffing, directing, controlling.

4 Hours

UNIT - 3

MANAGEMENT AND BEHAVIORAL APPROACH: contribution of Elton mayo and skinner and others to behavioral science, skills of a manager at various levels in an organization and inter related systems, under standing past behavior, predicting future behavior, directing, changing and controlling behavior; Maslow's hierarchy of needs and satisfaction, goal oriented behavior, integration of organizational goals and needs of employees, Hawthorn's studies and its finding, theory X and Y

10 Hours

UNIT - 4

PERSONAL MANAGEMENT: Recruitment and selection, training of personel employer and employee relationship, causes and settlement of disputes.

4 Hours

PART - B

UNIT - 5

PRODUCTION MANAGEMENT: Plant location, plant lay-out, CPM and PERT strategies, line balancing, automation statistical quality control; control chart, motion study.

7 Hours

UNIT - 6

INTERIOR WIRING SYSTEM: Wiring system, earthing, and estimation of wiring installation.

4 Hours

UNIT - 7

POWER INSTALLATION: Load calculation, wire size selection, wiring materials for power circuits, and the estimate for motor installation, pump set, workshop, theater etc.,

8 Hours

UNIT - 8

Depreciation and valuation of machinery, Inventory, Economic order quantity, break-ven analysis

6 Hours

TEXT BOOKS:

1. **"Introduction to Management"-**S. S. Chatterjee**,**
2. **"Engineering Economics and Management"** - N. Narasimhaswamy,
3. **"Electrical Estimation and Electrical Wiring Systems"**- Raghavendra Rao.

REFERENCE BOOKS:

1. **"Industrial Organization and Engineering Economics"-**T. R. Banga & S. C. Sharma.

POWER SYSTEM OPERATION AND CONTROL

Subject Code : **06EE82** 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: Introduction to SCADA, 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

65

UNIT - 2 & 3

AUTOMATIC GENERATION CONTROL: Automatic voltage regulator, automatic load frequency control, A VR control loops of generators, performance of A VR, ALFC of single area systems, concept of control area, multi-area systems, POOL operation-two area systems, tie-line bias control.

10 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.

8 Hours

PART - B

UNIT - 5

POWER SYSTEM OPTIMIZATION: Optimal system operation with thermal plants, incremental production cost for steam power plants, analytical form of generating cost of thermal plants, constraints in economic operation, flow chart, transmission loss as a function of plant generation, the Bcoefficients, examples.

8 Hours

UNIT - 6

UNIT COMMITMENT: Statement of the problem, need and importance of unit commitment, methods-priority lists method, dynamic programming method, constraints, spinning reserve, and examples.

8 Hours

UNIT - 7 & 8

POWER SYSTEM SECURITY: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, cotingency ranking.

10 Hours

TEXT BOOKS:

1. **"Computer Aided Power System Analysis"-** G.L.Kusic, PHI.
2. **"Modern Power System Analysis"-** I J Nagarath and D P Kothari, TMH, 1993.
3. **"Power generation, operation and control"**- Wood & B A J F Woollenberg. John Wiley and Sons, 1984.
4. **"Electric Power Systems"-**B. M. Weedy,

ELECTIVE-IV (GROUP D)
MODERN POWER SYSTEM PROTECTION

Subject Code : **06EE831** 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

STATIC RELAYS: Introduction, Basic construction, Classification, Basic Circuits, Smoothing Circuits, Voltage regulation, square wave Generator, Time delay Circuits, Level Detectors, Summation device, Sampling Circuits, Zero crossing detector, output devices.

8 Hours

UNIT - 2 & 3

COMPARATORS: Replica impedance, Mixing Transformers, General equation of phase and Amplitude, Comparators, Realization of ohm, mho, Impedance and offset impedance characteristics, Duality principle, Static amplifier comparator – Rectifier bridge circulations current type, sampling comparator, static phase comparator coincidence circuits type Rectifier phase comparator, Block split comparator, Zener diode phase comparator,

12 Hours

UNIT - 4

PRINCIPLES OF DIGITAL/ NUMERICAL RELAYS: Definition of Numerical Protection System, Advantages of Numerical relays, Block diagram of Numerical Relays, Processing Unit, non machines Interface, communication in protective relays, Information handling with sub station monitoring system.

6 Hours

PART - B

UNIT - 5

STATIC OVER CURRENT, TIMER AND VOLTAGE RELAYS: Instantanense over current Relay, Definite time lag relay, inverse time over current relay, static timer relay, Basic relay circuits, monostable delay circuits Single phase Instantaneous over voltage and under voltage relays,instantaneous over voltage relay using Op-amp.

10 Hours

UNIT - 6 & 7

DISTANCE RELAY: general Principle of operation, Zone discrimination, Fault area on impedance diagram, Basic measuring elements, Different characteristics used in distance relaying- Impedance, Reactance, Admittance. Ohm, Distance relay settings, Distance measurement Problems.

10 Hours

UNIT - 8

DIGITAL RELAYS: Block Schematic approach of microprocessor based relays, over current relay Protection, Transformer differential protection, Directional relay scheme, Impedance relay scheme.

6 Hours

TEXT BOOKS:

1. **"Power System Protection, Static Relays with Microprocessor applications"-** T.S. Madava Rao, TMH, Second editon, 2004.
2. **"Protective Relays and Protection"** -Van Warrington A. R. and Van C, Vol, I & II Chapman and Hall, 1968.

REFERENCE BOOKS:

1. **"Power System Protection"-**Patra. S.P. Basu. S.K. Choudhari.S. Oxford, and IBH Publications Co-1983.
2. **"Power System Protection and switchgear"-**Ravindranath. B and Chanda M. New age International
3. **"Power system protectonand switchgear"**-B.Ram and D.N Vishwa karma- TMH, 1997.
4. **"Fundamentals of Power System Protection"-** Y.G. pasthankar. S.R. Bhide PHI, 2007.

ELECTRICAL DISTRIBUTION SYSTEM

Subject Code : **06EE832** 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 POWER SYSTEM PLANNING AND AUTOMATION: 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, disperced 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, Mc GrawHill, 1986.
2. **"Electric power distribution"**-A S. Pabla, TMH, 5th edition, 2004.

OPERATION RESEARCH

Subject Code : **06EE833** 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

Introduction, definition, OR models characteristics and phases of OR. Modeling with linear programming: Two variable LP model, Graphical LP solution, model in equation form graphical to algebraic solution, simplex method artificial starting solution, Special cases in simplex method, sensitivity analysis.

10 Hours

UNIT - 3

DUALITY: Definition of the dual problem primal to dual relationships, economic interpretation of duality, additional implex algorithms.

6 Hours

UNIT - 4

TRANSPORTATION MODEL: definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model, traveling salesman problem.

10 Hours

PART - B

UNIT - 5

ADVANCED LINEAR PROGRAMMING: revised simplex method, dual simplex method, Bounded variable algorithm, parametric linear programming.

8 Hours

UNIT - 6

GAME THEORY: Formulation of two - person, zero sum games, solving simple games, the Max-min min-max principles, graphical solution procedure, solving by linear programming

8 Hours

UNIT - 7 & 8

PERT & CPM TECHNIQUES: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crassing of simple networks, PERT calculations.

10 Hours

TEXT BOOKS:

1. "**Operation Research An Introduction"**-Hamdy A Thoha, Pearson Education, 8th edition, 2007
2. "**Operations Research – Concept and Cases"-**Fredrick S Hillier and Lieverman TMH, 8th edition, 2007.

REFERENCE BOOK:

1. **"Optimization Techniques"-**S. S. Rao,

PROGRAMMABLE LOGIC CONTROLLERS

Subject Code : **06EE834** 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 counting, 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: Discussing the programming should be restricted to only one type of PLC (Mitsubhishi)

TEXT BOOKS:

1. **"Programmable Logic controllers"-**W Bolton, 4th edition, Elsevier- newness, 2006.
2. **"Programmable logic controllers** - **principles and applications"-** John W Webb, Ronald A Reis, **-**5th edition, 2nd impression, Pearson education, 2007.

REFERENCE BOOKS:

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

SOFTWARE ENGINEERING

Subject Code : **06EE835** I — A Marks : 25
No. of Lecture Hrs./ Week : 04 — Exam Hours : 03
Total No. of Lecture Hrs. : 52 — Exam Marks : 100

PART - A

UNIT - 1

OVERVIEW: Introduction to software engineering **Software processes:** software processes, Model process, iteration, software specification, software design and implementation software validation, software evolution, automated process support.

6 Hours

UNIT - 2 & 3

REQUIREMENTS ENGINEERING: Software Requirements: Functional and non-functional requirements, user requirements, system requirements, the software-required documents. **Requirements of Engineering:** processes feasibility studies, requirements elicitation and analysis, requirements validation, requirement, requirements management. **System Model:** Context Model, Behavior Models, Data Models, Object models, CASE workbench **Software Prototyping:** Prototyping in Software Processes, Rapid Prototyping Technique, and User-Interface Prototyping.

12 Hours

UNIT - 4

SOFTWARE DESIGN:

Architectural Design: System Structuring, Control Models, Modular Decomposition, And Domain Specific architecture. **Object Oriented Design:** Object and Object Classes, An object oriented design process, Design Evolution. **User Interface Design:** User interface design principles, User Interaction, Information Presentation User Support, Interface Evaluation.

10 Hours

PART - B

UNIT - 5

VERIFICATION VALIDATION:

Verification and validation Planning, Software Inspection, Automated Static Analysis, Clean Room Software Development. **Software Testing:** Defect Testing, Integration Testing, Object oriented testing, testing workbenches.

7 Hours

UNIT - 6

CRITICAL SYSTEM:

Critical System: Critical System, Availability and Reliability, Safety and Security.
Critical System Specification: Software reliability specification, Safety Specification.

4 Hours

UNIT – 7

SOFTWARE MANAGEMENT:

Project Management: Management Activities, Project Planning, Project Scheduling, and Risk Management. **Software Cost Estimation:** Productivity, Estimation Techniques, Algorithmic Cost Modeling, Project Duration and staffing. **Quality Management:** Quality Assurance and standards, Quality Planning, Quality Control, Software Measurements and Metrics.

9 Hours

UNIT - 8

SOFTWARE EVOLUTION:

Legacy System: Legacy System Structure, Legacy System Design and Assessment.
Software Re-Engineering: Source Code Translation, Reverse Engineering, Program Structure Improvement, and Program Modularization, Data Reengineering.

4 Hours

TEXT BOOK:

1. **"Software Engineering"-**an Sommerville**,** 7th Edition, Pearson education, 2005.

FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)

Subject Code : **06EE836** 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 thryrirstor, emitter turn OFF thryristor, 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 bridge converter.

6 Hours

PART - B

UNIT - 5

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

6 Hours

UNIT - 6

STATIC SHUNT COMPENSATORSVC AND STATCOM: objective of shunt compensation, methods of controllable Var generation, static Var compensator, SVC and STATCOM, comparison between, SVCandSTATCOM.

10 Hours

UNIT - 7 & 8

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

10 Hours

TEXT BOOK:

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

REFERENCE BOOK:

1. **"EHV – AC, HVDC Transmission & Distribution Engineering" 3rd edition-**S. Rao Khanna publishers, 2003.

DATA COMMUNICATION AND NETWORKING

Subject Code : **06EE837** 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

INTORDUCTION: Data Communication, Data representation, Data Flow,

4 Hours

NETWORKS: Network Criteria's, Physical Strictures, Physical Topology, Network Models, LAW VAN MAN Internet, Protocol & Standers.

6 Hours

UNIT - 2

NETWORK MODELS: Layered Tasks Layers in OSI Model TCI Protocol Suite Addressing. Physical Layer and Media- Data & Signal Analog & Digital Signal Transmission inspiration Data rate limits, performance

8 Hours

UNIT - 3

DIGITAL TRANSMISSION: Digital to digital conversion analog to digital conversion, Transmission modes.

4 Hours

UNIT - 4

Analog transmission: digital to analog conversion and analog to anlog conversion band width utilization y multiplexing.

4 Hours

PART - B

UNIT - 5

TRANSMISSION MEDIA: guided media, wireless, the medium access sub layers aloma protocols, LAN protocols IEEE standard 802 Ethernet LAN fiber optic networks, satellite network pocket radio network

8 Hours

UNIT - 6

THE DATA LINK LAYER: Introduction types of error, reducing detection verses correction, elementary data link protocols performance sliding window protocol

6 Hours

UNIT - 7

THE NETWORK LAYER INTERNETWORKING, datagram containerless network conjession control open & close loop conjession control tropic shaping leakay bucket token bucket algorithems interact as datagram network and connection less network

8 Hours

UNIT - 8

TRANSPORT LAYER: Process to process layer delivery claint server pardiagam connection less verses connection orient user data gram protocall (UDP) UDP operation TCP services and features.

4 Hours

TEXT BOOKS:

1. **"Data Communication And Networking"-** 4th edition**,** Beurouz Fafrouz Zan,
2. **"Computer Networks"** - Tanenbaum**,** PHI 3rd edition, Pearson

REFERENCE BOOKS:

1. **"Network for Computer Scientist And Engineers"-**Youn Zhen, Oxford press 2002.
2. "**Data & Computer Networks"**U Stallings, 5th edition, PHI 1998.
3. **"Computer Networks"-** James F Kurose and K W Ross, Pearson.

ELECTIVE -V (GROUP – E)
POWER SYSTEM DYNAMICS AND STABILITY

Subject Code : **06EE841** 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. McGraw- Hill Publishing Company, NY.

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

ELECTROMAGNETIC COMPATIBILITY

Subject Code : **06EE842** 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 adsorption 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"**- 2nd edition, Henry W. Ott, John Wiley, 1988

RENEWABLE ENERGY SOURCES

Subject Code : **06EE843** 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

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, Soalr Furnces, 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 a 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 Limitation 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 & Limitation 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"- 4th Edition,**Rai, G. DKhanna Publishers, New Delhi, 2007
2 . **"Non-Conventional Energy Resources"-** Khan, B. H., TMH, New Delhi, 2006.

REFERENCE BOOK:

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

HVDC TRANSMISSION

Subject Code : **06EE844** 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: General, 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.

ELECTRICAL POWER QUALITY

Subject Code : **06EE845** 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, monitoring sags.

6 Hours

UNIT - 3 & 4

TRANSIENTS 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

10 Hours

UNIT - 6

POWER QUALITY BENCHMARK: introduction, benchmark process, power quality contract, power quality state estimation, including power quality in distribution planning, Interface to utility system, power quality issues, interconnection standards

10 Hours

UNIT - 7 & 8

POWER QUALITY MONITORING: Monitoring considerations, power quality measurement equipments, assement 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.

COMPUTER CONTROL OF ELECTRICAL DRIVES

Subject Code : **06EE846** 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 Assocition (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

PRINCIPALS 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,

DATA BASE MANAGEMENT SYSTEMS (DBMS)

Subject Code : **06EE847** 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

ENTITY – 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

5 Hours

UNIT - 3

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

8 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 of SQL, specifying general constraints as assertion, views (virtual tables) in SQL, database Programming, issues and Techniques, Embedded SQL, Dynamic SQL.

9 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, Algorithms for Relational Database Scheme Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.

10 Hours

UNIT - 6

DATABASE SECURITY: Introduction Security, Access control, Discretionary Access, Mandatory Access Control

3 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, ss for 4rializability 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.

13 Hours

TEXT BOOKS:

1. **"Database Management Systems"** 3rd Edition, Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill, 2003.
2. **"Fundamentals of Database Systems"-**Elmasri and Navathe**,** 4th Edition, Pearson Education, 2003.

— — — — — — —