REVISED **SCHEME OF TEACHING & EXAMINATION-Dated 19th and 20th Mar 2010**

V SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

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

@- Any Engineering department or department of Business study.

10AL51 Management and Entrepreneurship

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

10EE52 SIGNALS AND SYSTEMS

Subject Code	:	**10EE52**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

UNIT – 2 and 3

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

10 Hours

UNIT - 4

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

PART - B

UNIT - 5

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

7 Hours

UNIT - 6

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

7 Hours

UNIT –7 and 8

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

12 Hours

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE53 TRANSMISSION AND DISTRIBUTION

Subject Code	:	10EE53	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

5 Hours

UNIT - 2

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

5 Hours

UNIT – 3

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

6 Hours

UNIT - 4

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

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

6 Hours

Part - B

UNIT – 5 and 6

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

12 Hours

UNIT - 7

Performance of power transmission lines- Short transmission lines, medium transmission lines- nominal T, end condenser and π models, long transmission lines, ABCD constants of transmission lines, Ferranti effect, line regulation. Power flow through lines, P-V & Q-V curves.

8 Hours

UNIT - 8

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE54 D.C. MACHINES AND SYNCHRONOUS MACHINES

Subject Code	:	10EE54	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

8 Hours

UNIT - 2

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

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

UNIT – 3 and 4

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

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

10 Hours

PART - B

UNIT - 4

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

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, operation 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

UNIT - 8

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE55 MODERN CONTROL THEORY

Subject Code	:	10EE55	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

REFERENCE BOOKS:

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

10EE56 LINEAR IC'S AND APPLICATIONS

Subject Code	:	10EE56	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OP-AMPS AS AC AMPLIFIER: Capacitor coupled voltage follower, high 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.**7 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 mode compensation, circuit stability precautions.**7 Hours**

UNIT - 3

SIGNAL PROCESSING CIRCUITS: Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample &hold circuit.**6 Hours**

UNIT - 4

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

PART - B

UNIT - 5

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

UNIT - 6

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

7 Hours

UNIT - 7

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

UNIT - 8

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

4. **Linear Integrated Circuits- Analysis,Design and Applications,**B.Somanathan Nair, Wiley India, First,Edition, 2009.

10EEL57 MEASUREMENTS AND CIRCUIT SIMULATION LABORATORY

Subject Code	:	10EEL57	IA Marks	:	25
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lecture 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
   b) RC phase shift oscillator using op amps (Both using simulation package)
9. RC coupled amplifier-frequency response for variation of bias & coupling using simulation package
10. Rectifier circuits-Bridge rectifier, diode clipping & clamping circuits using simulation package.
11. Schmitt –trigger- inverting and non-inverting.
12. Signal generator- triangular, saw tooth and rectangular wave generation

10EEL58 TRANSFORMERS AND INDUCTION MACHINES LABORATORY

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

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

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

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

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

4.Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load. Polarity test to be conducted on both AC and DC supply.

5. Scott connection with balanced and unbalanced resistive loads.

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

7. (a)Determination of parameters of the equivalent circuit of a 3-phase Induction Motor by conducting Open Circuit and Blocked rotor tests.

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

8. Predetermination of performance of 3-phase induction Motor from the Circle diagram.
9.Determination of performance quantities of the induction motor from the equivalent circuit to correlate the

results obtained from the load test and circle diagram.

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

****

REVISED **SCHEME OF TEACHING & EXAMINATION-Dated 19th and 20th Mar 2010**

VI SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

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

Elective-I (Group A)

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

10EE61 POWER SYSTEM ANALYSIS AND STABILITY

Subject Code	:	**10EE61**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

UNIT - 2

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

UNIT - 3 & 4

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

12 Hours

Part - B

UNIT - 5 & 6

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

UNIT - 7

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

UNIT – 8

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

TEXT BOOKS:

1. **Elements of Power System Analysis**, W.D.Stevenson, TMH,4th Edition
2. **Modern Power System Analysis**,.I. J. Nagrath and D.P.Kothari- TMH, 3rd Edition,2003.

REFERENCE BOOKS:

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

10EE62 SWITCHGEAR & PROTECTION

Subject Code	:	10EE62	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

4 Hours

UNIT - 2

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

10 Hours

UNIT - 3 & 4

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

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

12 Hours

PART - B

UNIT - 5

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

4 Hours

UNIT - 6

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

10 Hours

UNIT - 7 & 8

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

TEXT BOOKS: ,

1. **Switchgear & Protection** Sunil S.Rao,,Khanna Publishers,13th Edition,2008.
2. **Power System Protection & Switchgear,** Badriram & Viswa Kharma ,TMH,1st edition, 2001.

3. **Fundamentals of Power System protection,** Y G. Painthankar and S R Bhide,PHI, 2009.

REFERENCE BOOKS:

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

10EE63 ELECTRICAL MACHINE DESIGN

Subject Code	:	**10EE63**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

4 Hours

UNIT - 2

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

10 Hours

UNIT - 3 & 4

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

PART - B

UNIT - 5 & 6

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

UNIT - 7 & 8

DESIGN OF SYNCHRONOUS MACHINES: Output equation, Choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non-salient pole machine . **12 Hours**

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE64 DIGITAL SIGNAL PROCESSING

Subject Code	:	**10EE64**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 and 2

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

14 Hours

UNIT – 3 and 4

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

.

PART - B

UNIT – 5 AND 6

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

10 Hours

UNIT 7

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

`8 Hours

UNIT - 8

REALIZATION OF DIGITAL SYSTEMS: Introduction, block diagrams and SFGs, 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. **08 Hours**

TEXT BOOKS:

1. **Digital Signal Processing Principle, Algorithm & application**, Proakis, Pearson,4th education, 2009.
2. **Digital Signal Processing ,** Sanjeet. K. Mitra ,TMH,3rd Edition,2009.

REFERENCE BOOKS:

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

10EE65 CAED (COMPUTER AIDED ELECTRICAL DRAWING)

Subject Code	:	**10EE65**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

1. Winding Diagrams

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

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

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

(ii) Single layer windings – Un-bifurcated 2 and 3 tier windings, mush windings, Bifurcated 2 and 3 tier windings. **20 Hours**

PART - B

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

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

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

1**. Manuals of Auto - CAD**

Elective-I (Group A)
10EE661 RENEWABLE ENERGY SOURCES

Subject Code	:	**10EE661**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

4 Hours

UNIT - 2

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

6 Hours

UNIT - 3

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

6 Hours

UNIT - 4

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

7 Hours

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

3 Hours

PART - B

UNIT - 5

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

8 Hours

UNIT - 6

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

6 Hours

UNIT - 7

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

6 Hours

UNIT - 8

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

TEXT BOOKS:

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

REFERENCE BOOK:

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

10EE662 ADVANCED POWER ELECTRONICS

Subject Code	:	**10EE662**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

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

UNIT - 3 & 4

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

10 Hours

PART - B

UNIT - 5

RESONANT CONVERTERS: Zero voltage and zero current switching, resonant switch converters, and comparison with hard switching, switching locus diagrams, and working principle. **6 Hours**

UNIT - 6

HIGH FREQUENCY INDUCTOR AND TRANSFORMERS: Design principles, definitions, comparison with conventional design and problems. **10 Hours**

UNIT - 7 & 8

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

TEXT BOOKS:

1. **Power Electronics,** Daniel.W.Hart, TMH, First Edition,2010.
2. **Power Electronics - converters, application & design**, Mohan N, Undeland T.M., Robins, W.P,John Wiley ,3rd Edition 2008
3. **Power Electronics-Circuits, Devices, Applications,** Rashid M.H., PHI, 3rd Edition, 2008.
4. **Modern Power Electronics and A.C. Drives,** Bose B.K, PHI, 2009.
5. **Digital Power Electronics And Applications,** Muhammad Rashid, Elsevier , first edition, 2005.
6. **Power Electronics,Devices,Circuits and Industrial Applications**,V.R.Moorthi,Oxford,7th impression,2009.

10EE663 FUZZY LOGIC

Subject Code	:	**10EE663**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

THE MATHEMATICS OF FUZZY CONTROL: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

8 Hours

UNIT - 2, 3 and 4

THEORY OF APPROXIMATE REASONING: Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference.

NON-LINEAR FUZZY CONTROL: FKBC as a linear transient element, PID like FKBC, sliding mode FKBC, Sugeno FKBC.

18 Hours

PART - B

UNIT - 5 and 6

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

14 Hours

UNIT - 7 and 8

ADAPTIVE FUZZY CONTROL: Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

12 Hours

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE664 OBJECT ORIENTED PROGRAMMING USING C ++

Subject Code	:	**10EE664**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

4 Hours

UNIT - 2

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

6 Hours

UNIT - 3

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

8 hours

UNIT - 4

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

8 Hours

PART - B

UNIT - 5

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

4 Hours

UNIT - 6

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

7 Hours

UNIT - 7

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

6 Hours

UNIT - 8

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

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

9 Hours

TEXT BOOKS:

1. **Object Oriented Programming with C++**- Balagurusamy, E, TMH,4th edition, 2008.
2. **C++, The Complete Reference** -Herbert Schildt**,** , TMH, 4th edition
3. **Standard C++**, 2nd edition, Thomson Learning, Vikas Publishing House.

REFERENCE BOOKS:

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

10EE665 EMBEDDED SYSTEMS

Subject Code	:	**10EE665**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

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

10 Hours

UNIT - 3

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

10 Hours

UNIT - 4

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

6Hours

PART - B

UNIT - 5 & 6

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

12 Hours

UNIT - 7 & 8

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

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

TEXT BOOKS:

1. **Embedded Microcomputer systems: Real time interfacing-** Valvano, J.W, Cengage Learning,2nd Edition 5th Indian reprint,2009
2. **The Art of Designing Embedded systems**- Ganssle, Jack, Newness
3. **Embedded System, Architecture, Programming and Design-** Raj Kamal ,TMH,2nd Edition 2008.

REFERENCE BOOKS:

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

10EE666 ELECTRICAL ENGINEERING MATERIALS

Subject Code	:	**10EE666**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

6 Hours

UNIT - 2

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

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

10 Hours

UNIT - 3 & 4

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

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

10 Hours

PART - B

UNIT - 5

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

6 Hours

UNIT - 6

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

6 Hours

UNIT - 7

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

6 Hours

UNIT - 8

Ceramics: properties, application to conductors, insulators & capacitors

Plastics: Thermoplastics, rubber, thermostats, properties.

8Hours

TEXT BOOKS:

1.An Introduction to Electrical Engineering- Indulkar C.S. & Thiruvengadam. S.

2.Materials Science for Electrical and Electronic Engineers, Ian P**.** Jones, Oxford University Press,Indian Edition, 2007.

3.Electrical Engineering Materials,Kapoor P L., Khanna Publications.

4.Renewable Energy Sources and Emerging Technologies, D.P. Kothari, K.C. Singal, Rakesh Ranjan. PHI, 2008

REFERENCES:

1.Electrical Properties of Materials, L.Solymar, D.Walsh, 8th Indian Edition- Oxford University Press Seventh Edition.

2.Renewable Energy Sources and Emerging Technologies, D.P. Kothari, K.C. Singal, Rakesh Ranjan. PHI, 2008**.**

3.MEMS and MOEMS Technology and Applications, P.Rai-Choudhury (Editor), PHI,2009 .

10EEL 67 DC MACHINES AND SYNCHRONOUS MACHINES LABORATORY

Subject Code	:	**10EEL67**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	42	Exam Marks	:	50

1. Load characteristics of a D.C. shunt and compound generator - i) Short shunt-Cumulative and Differential (ii) Long shunt-Cumulative and Differential.
2. Load test on a DC motor- determination of speed-torque and HP-efficiency characteristics.
3. Swinburne's Test.
4. Hopkinson's Test.
5. 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.
14. Measurement of X_1, X_2 and X_o of a Synchronous generator

10EEL68 CONTROL SYSTEMS LABORATORY

Subject Code	:	**10EEL68**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	42	Exam Marks	:	50

1. Using MATLAB/SCILAB a) Simulation of a typical second order system and determination of step response and evaluation of time- domain specifications
   b) Evaluation of the effect of additional poles and zeroes on time response of second order system
   c) Evaluation of effect of pole location on stability
   d) Effect of loop gain of a negative feedback system on stability
2. (a) To design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequency response.
   (b) To determine experimentally the transfer function of the lead compensating network.
3. (a) To design RC lag compensating network for the given specifications., viz., the maximum phase lag and the frequency at which it occurs, and to obtain its frequency response.
   (b) To determine experimentally the transfer function of the lag compensating network.
4. Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
5. To study the effect of P, PI, PD and PID controller on the step response of a feedback control system (using control engineering trainer/process control simulator). Verify the same by simulation.
6. a) Experiment to draw the speed – torque characteristic of a two - phase A.C. servomotor.
   b) Experiment to draw speed torque characteristic of a D.C. servomotor.
7. To determine experimentally the frequency response of a second -order system and evaluation of frequency domain specifications.

8. Using MATLAB/SCILAB

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

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

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

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

9. Using MATLAB/SCILAB

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

10. Using MATLAB/SCILAB

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

11. Experiment to draw to syncro pair characteristics.

****