10EE61 POWER SYSTEM ANALYSIS AND STABILITY

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

PART - A

UNIT - 1

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

UNIT - 2

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

UNIT - 3 & 4

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

12 Hours

Part - B

UNIT - 5 & 6

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

UNIT - 7

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

UNIT – 8

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. **Power System Analysis**, Hadi Sadat, TMH,2nd Edition.
2. **Power system Analysis**, R.Bergen, and Vijay Vittal, Pearson publications, 2nd edition, 2006.

3. **Computer Aided Power system analysis**, G.L., Kusic, PHI.Indian Edition, 2010 .
4. **Power System Analysis**,W.D.Stevenson & Grainger,TMH, First Edition, 2003.

10EE62 SWITCHGEAR & PROTECTION

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

PART - A

UNIT - 1

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

4 Hours

UNIT - 2

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

10 Hours

UNIT - 3 & 4

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

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

12 Hours

PART - B

UNIT - 5

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

4 Hours

UNIT - 6

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

10 Hours

UNIT - 7 & 8

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

TEXT BOOKS: ,

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

REFERENCE BOOKS:

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

10EE63 ELECTRICAL MACHINE DESIGN

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

PART - A

UNIT - 1

PRINCIPLES OF ELECTRICAL MACHINE DESIGN: Introduction, considerations for the design of electrical machines, limitations. Different types of materials and insulators used in electrical machines. **4 Hours**

UNIT - 2

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

UNIT - 3 & 4

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

PART - B

UNIT - 5 & 6

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

UNIT - 7 & 8

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE64 DIGITAL SIGNAL PROCESSING

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

PART - A

UNIT - 1 and 2

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

14 Hours

UNIT – 3 and 4

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

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PART - B

UNIT – 5 AND 6

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

UNIT 7

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

`8 Hours

UNIT - 8

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE65 CAED (COMPUTER AIDED ELECTRICAL DRAWING)

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

PART - A

1. Winding Diagrams

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

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

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

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

2. Single line diagrams of generating stations and substations. **6 Hours**

PART - B

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

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

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

(c) Alternator – sectional views of stator and rotor dealt separately. **26Hours**

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**

Note: Problems / Examples to be solved by Auto-CAD, may be picked up from above references.

Elective-I (Group A)

10EE661 OPERATION RESEARCH

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

PART – A

Unit – 1
Linear Programming, Introduction, formulation of linear programming problem, Standard and matrix from, graphical solution, simplex method, computational procedure, Big-M method, Two-phase simplex method. **8 Hours**

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

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

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

PART – B

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

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

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

TEXT BOOK:

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

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

10EE662 ADVANCED POWER ELECTRONICS

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

PART - A

UNIT - 1 & 2
DC-DC SWITCHED MODE CONVERTERS: Topologies, Buck, boost, buck-boost, and Cuk converters, Full Bridge DC-DC converter-detailed theory, working principles, modes of operation, with detailed circuits and wave forms, applications, merits and demerits. **16 Hours**

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

10 Hours

PART - B

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

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

UNIT - 7 & 8

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

TEXT BOOKS:

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

REFERANCE BOOKS:

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

10EE663 FUZZY LOGIC

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

PART - A

UNIT - 1
THE MATHEMATICS OF FUZZY CONTROL: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle. **8 Hours**

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

PART - B

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE664 OBJECT ORIENTED PROGRAMMING USING C ++

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

PART - A

UNIT - 1

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

UNIT - 2

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

UNIT - 3

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

UNIT - 4

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

PART - B

UNIT - 5

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

UNIT - 6

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

UNIT - 7

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

UNIT - 8

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

10EE665 EMBEDDED SYSTEMS

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

PART - A

UNIT - 1 & 2

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

UNIT - 3

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

UNIT - 4

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

PART - B

UNIT - 5 & 6

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

UNIT - 7 & 8

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

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

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

10EE666 ELECTRICAL ENGINEERING MATERIALS

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

PART - A

UNIT - 1

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

UNIT - 2

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

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

UNIT - 3 & 4

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

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

PART - B

UNIT - 5

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

UNIT - 6

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

UNIT - 7

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

UNIT - 8
Ceramics: properties, application to conductors, insulators & capacitors
Plastics: Thermoplastics, rubber, thermostats, properties.

8Hours

TEXT BOOKS:

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

REFERENCES:

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

10EEL 67 DC MACHINES AND SYNCHRONOUS MACHINES LABORATORY

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

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

10EEL68 CONTROL SYSTEMS LABORATORY

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

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

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

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

8. Using MATLAB/SCILAB

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

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

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

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

9. Using MATLAB/SCILAB

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

10. Using MATLAB/SCILAB

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

11. Experiment to draw to syncro pair characteristics.

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