Shivaji University, Kolhapur

Electrical & Electronics

Engineering Syllabi

B.E. Part- I & II

(Semester VII to VIII) SYLLABI

(Structure Semester VII to VIII)

Introduced From July 2013 Onwards

Shivaji University, Kolhapur

Syllabus Structure of Final Year (Semester VII)

Electrical & Electronics Engineering

Scheme of Teaching and Examination

B.E.-Part-I (SEM- VII)

Sr. No.	Subject	Teaching scheme(Hrs)				Examination Scheme(Marks)				
		L	T	P	TOTAL	THEORY	TW	POE	OE	TOTAL
1	SWITCHGEAR & PROTECTION	4	1	2	7	100	25	50	--	175
2	CONTROL SYSTEM DESIGN	4	1	2	7	100	25	50	--	175
3	FACTS	4	1	--	5	100	25	--	--	125
4	INDUSTRIAL MANAGEMENT AND ECONOMICS	4	--	--	4	100	--	--	--	100
5	ELECTIVE I*	4	1	--	5	100	25	--	--	125
6	PROJECT-I.	-	-	2	2	--	50	50	--	100
	TOTAL	20	4	6	30	500	150	150	--	800

List of the Elective Subjects:
ELECTIVE –I *
1) EHVAC
2) Robotics
3) Electrical system modeling.
4) Neural Network &Fuzzy Logic
5) Nonlinear and Digital Control Systems

Shivaji University, Kolhapur
Syllabus Structure of Final Year (Semester VIII)

Electrical & Electronics Engineering

Scheme of Teaching and Examination

B.E.-Part-II (SEM- VIII)

Sr. No.	Subject	Teaching scheme(Hrs)				Examination Scheme(Marks)				
		L	T	P	TOTAL	THEORY	TW	POE	OE	TOTAL
1	ELECTRICAL MACHINE DESIGN	4	1	2	7	100	25	50	--	175
2	UTILIZATION & ENERGY CONSERVATION	4	1	2	7	100	50	--	--	150
3	EMBEDDED SYSTEMS	4	1	2	7	100	25	25	--	150
4	ELECTIVE II*	4	1	--	5	100	25	--	--	125
5	PROJECT-II.	--	--	4	4	--	100	100	--	200
	TOTAL	16	4	10	30	400	225	175	--	800

List of the Elective Subjects:
ELECTIVE –II*
1) HVDC
2) Power System Harmonics
3) Electrical & Electronic Materials
4) VLSI Design

SEMISTER – VII

01. SWITCHGEAR AND PROTECTION

Teaching Scheme:	Examination Scheme:
Lectures: 04 Hours/Week	Paper: 100 Marks
Tutorials: 01 Hours/Week	T.W.: 25 Marks
Practical: 02 Hours/Week	POE: 50 Marks

SECTION I

UNIT I (8 hours)

Switches & Fuses :- Introduction, definition of switch gear, switches - isolating, load braking&earthing, Introduction to fuse, fuse law cut off characteristics, time – current characteristics, fuse material, HRC fuse, liquid fuse, applications of fuse

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.Restriking Phenomenon, Average and Max, RRRV, NumericalProblems, Current Chopping and Resistance Switching, CB ratings and Specifications, TypesandNumericalProblems.Auto reclosures. Description and Operation of following types of circuit breakers:, Air Blast Circuit Breakers andSF6 circuit breakers.

UNIT II (8 hours)

Electromagnetic and Static Relays: Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays.Relays Classification: Instantaneous, DMT and IDMT types.

Application of relays: Over current/under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays.Universal torque equation, Distance relays: Impedance, Reactance andMho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison.

Static Relays: Static Relays verses Electromagnetic Relays.

UNIT III (8 hours)

Generator Protection

Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on% Winding Unprotected.

Transformer Protection

Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

SECTION II

UNITIV(8 hours)

Feeder and Bus-Bar Protection: Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays.Translay Relay.Protection of Busbars– Differential protection.

UNIT V (8 hours)

Neutral Grounding

Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance.Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

UNIT VI (8 hours)

Sources of Over voltages and Protection against over voltages .-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters Insulation Coordination - BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics.

TERM WORK:

Ten laboratory exercises consist of minimum 04 exercises using MATLAB.

REFERENCEBOOKS:

1. Switchgear and Protection –by Sunil S Rao, KhannaPubllishers
2. Power System Protection and Switchgear by Badari Ram , D.N Viswakarma, TMH Publications
3. FundamentalsofPower SystemProtectionby Paithankarand S.R.Bhide.,PHI,2003.
4. Art &Science of Protective Relaying– by C R Mason,WileyEastern Ltd.
5. ElectricalPower Systems–by C.L.Wadhwa, New Ageinternational(P)Limited, Publishers, 3rd editon
6. A Text book on Power System Engineering by B.L.Soni, Gupta, Bhatnagar, Chakrabarthy, DhanpatRai& Co
7. Electrical Power by S. L. Uppal

SEMISTER – VII

02. CONTROL SYSTEM DESIGN

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week
Practical: 02 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
POE: 50 Marks

SECTION I

UNIT I (8 hours)

Principles of feedback control: Control objective, feedback control system characteristic, Tuning rules for PID controllers, modification of PID control schemes, Proportional mode, integral mode, derivative mode of control system, alternative control system configurations.

UNIT II (8 hours)

Compensator design using Root locus: Review of root locus concept, cascade lead compensation, cascade lag compensation, cascade lag -lead compensation, minor loop feedback compensation, parallel compensation, compensation for plants with dominant complex poles,. root locus of system with dead time, sensitivity of root locus

UNIT III (8 hours)

System stability and performance in frequency domain: Review of Nyquist criterion, stability margins, stability margins on Bode plots, stability analysis with dead time, frequency response measurement, co-relation between time and frequency domain specification, M circles andN circles , Nichole's charts, sensitivity in frequency domain.

SECTION II

UNIT IV (8 hours)

Compensator design using Bode Plot: Introduction, Reshaping Bode plot, cascade lead compensation, cascade lag compensation, cascade lag -lead compensation,

UNIT V (8 hours)

State space Design in Continuous time: Review of state space, controllability, observability, controller design using pole placement, Ackermann's formula, observer design using error dynamics, Ackermann's formula.

UNIT VI (8 hours)

Design of Digital control system using state space: Review of 'Z' transform, controllability, observability, Controller design using Pole placement, Ackermann's formula, observer design

TERM WORK:
Minimum 10 Experiments based on above syllabus using MATLAB.

REFERENCE BOOKS:

1. Modern Control Engineering Eastern Economy, K. Ogata, 4th Edition, 2002.
2. Control system principles and design, M. Gopal, TMH publication, 3rd edition, 2008
3. Process control Instrumentation Technology by – C. D. Johnson, Pearson Education Ltd,7th Edi., 2005
4. Automatic Control Engineering – Raven F. H McGraw Hill, 5th Edition, 1995
5. Feedback Control Systems, C. L. Phillips, R. D. Harbor PHI publication, 1988
6. Modern Control System - Nagoor-Kani
7. Discrete Time Control Systems – K. Ogata

SEMISTER – VII
03. FACTS

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorial:01 Hours/Week

Examination Scheme:
Paper: 100 Marks
Term Work 25 Marks

SECTION I

UNIT I (8 hours)

Introduction to FACTS: Introduction of the facts devices and its importance intransmission network. Introduction to basic types of facts controller, comparison of HVDCand facts.

UNIT II (10 hours)

Power Semiconductor Devices and Voltage Source Converters: Types of high power devices, Principle of High power devices characteristics and requirements, Power device material, Basic concept of voltage source converters, Single phase full wave bridge converter operation, Single phase leg operation, Square wave voltage harmonics for single phase bridge, three phase full wave bridge converter, pulse width modulation converter

UNIT III (10 hours)

STATIC SHUNT COMPENSATORS : SVC AND STATCOM objectives of the shuntcompensation ,method of controller VAR generator , transfer function dynamicsperformance of SVC andSTATCOM, VAR reserve control,comparison betweenSTATCOM AND svc STATIC VAR system

SECTION II

UNIT IV (10 hours)

STATIC SERIES COMPENSATORS: GCSC,TSSC, TCSC AND SSSC objectives of theseries compensation , series capacitive compensation , power oscillation damping , variableImpedance type series compensation switching converter type series compensator schematics of seriescompensator.

UNIT V (10 hours)

COMBINED COMPENSATOR: UPFC and IPFC, UPFC - Basic principle and reactivepower control structure basic control system for P & Q control, comparison of UPFC toseries compensator and phase angle regulations.IPFC-Basic operating principlecharacteristics, Control structure and applications.

REFERENCE BOOKS:

1.Understanding FACTS - Concept and Technology of flexible AC Transmission systems. : N.G. Hingorani& L. Gywgyi IEE Press.
2. Static Reactive power compensation : T.J.E. Miller, Jhonwiley and sons New York

SEMISTER – VII
04. INDUSTRIAL MANAGEMENT AND ECONOMICS

Teaching Scheme: Examination Scheme:
Lectures: 04 Hours/Week Paper: 100 Marks

SECTION I

UNIT I (8 hours)

Industrial Management: Principles and Importance of management,Functions of management, Decision making process

Operations Management: Production concept, production planning and control, manufacturing systems: types and characteristics, plant layout types, need and characteristic, salary and wage administration,

UNIT II (8 hours)

Human Resource Management: Concept, Objective and Functions of HRM, Principles of good HR policy, Incentives : types and characteristics

Financial Management: Types of Capital, Source of finance,Institutions building Industrial finance, Taxation policies, Taxes: direct and indirect

UNIT III (8 hours)

Marketing Management: Functions of Marketing, Market research, Sales Management, Sales organization and its functions, sales forecasting, The selling and marketing concept

Network Analysis: Network Techniques, Terms related to Network Planning, PERT,CPM, Applications of Network Technique.

SECTION II

UNIT IV (8 hours)

Material Management: Introduction to Material Management, Purchasing, Buying Technique, Purchasing procedure, Inventory control, InventoryManagement, Material requirement planning

Total Quality Management: Definition, Quality obstacles, Benefits of TQM,ISO registration benefits, ISO 9000 series standards, sector specific standards, ISO 9001requirements, Introduction to ISO 14000 series, Testing standards

UNIT V (8 hours)

Industrial Acts.: Indian factory act, Indian Electricity act, The Workmen's compensation act, Consumer Protection act

Engineering Economics: Meaning of economics, difference between value and price, law of demand and supply, demand forecasting methods, Banks: functions and types, RBI, SEBI, modern concepts like SEZ,PPP, BOT.

UNIT VI (8 hours)

Management Information Systems: Introduction, Elements, Structure and Requirements of MIS, Decision support system

Operations Research: LPP(Graphical only) , Transportation Problem, Assignment Problem, Inventory Model (EOQ, Stock levels)

REFERENCE BOOKS:

1. Industrial Engineering and Management: O.P. Khanna; Dhanpatrai and Company
2. Management Information Systems By G.B. Davis, M.H. Olson: McGrawhill; International Edition
3. Total Quality Management By D.H. Besterfield, C.B. Michana& others; PHI Pvt. Ltd.
4. ISO 900 quality systems: A. N. Singh; Dolphin Book N Delhi
5. Business organization and management: M.C. Shukla; S. Chand
6. Operations Research by S. D. Sharma

SEMISTER – VII
05. EHVAC
(Elective-I)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTION I

UNIT I (8 hours)

Preliminaries: NecessityofEHVACtransmission, advantages and problems, power handlingcapacityand line losses, mechanical considerations, resistanceofconductors, properties of bundled conductors, bundlespacingandbundleradius, Examples.

UNIT II (8 hours)

Lineand ground parameters:

Lineinductance and capacitances, sequence inductances and capacitances, modesof propagation, ground return, Examples

Voltage gradientsof conductors:

Electrostatics, field of sphere gap, field of line changes and properties, charge, potential relations formulti-conductors, surface voltage gradient on conductors, distribution of voltage gradient on sub-conductors of bundle– Examples.

UNIT III (8 hours)

Corona effects –I:

Power loss and audible noise (AN), corona loss formulae, charge voltage diagram, generation,characteristics, limits and measurements of AN, relation between 1-phase and 3-phase AN levels, Examples.

SECTION II

UNIT IV (8 hours)

Coronaeffects– II:

Radio interference (RI), coronapulsesgeneration, properties,limits, frequency spectrum, modes ofpropagation, excitation function, measurementofRI,RIVand excitation functions, Examples.

UNIT V (8 hours)

Electrostatic field: Electrostatic field: calculationof electrostaticfield of EHV/AClines – effect on humans, animalsandplants, electrostatic induction in non-energized circuit of double circuit line, electromagnetic interference-Examples.

Travelingwave theory: Traveling wave expression and solution- source of excitation-terminal conditions- open circuited andshort-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants No-load voltageconditionsand charging current.

UNIT VI (8 hours)

Voltagecontrol: Power circle diagram and its use – voltage control using synchronous condensers – cascade connectionof shunt and series compensation – sub synchronous resonance in series capacitor – compensated linesstatic VAR compensatingsystem.

REFERENCE BOOKS:

1. EHVACTransmissionEngineeringbyR. D. Begamudre, New AgeInternational(p) Ltd.
2. HVACand DC Transmission byS.Rao

SEMISTER – VII
05. ROBOTICS
(Elective-I)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTION I

UNIT I **(6 hours)**

Introduction: fundamental of industrial robots, classification of robots, robotic – like devices, classification by co-ordinate system, cylindrical co-ordinate robots, spherical coordinate robots, jointed arm robots, Cartesian co-ordinate robots, classification by control method,non servo controlled robots, servo controlled robots, point to point servo controlled robots, continuous path servo controlled robots, major components of robots, fixed versus flexible automation, economic consideration, sociological consequences of robots, state of art survey

UNIT II **(8 hours)**

Robotic end-effectors: introduction,classification of end-effectors,drive system for grippers, mechanical gripper, magnetic grippers,vacuumegrippers,adhesivegrippers,hooks,scoops& other miscellaneous devices, gripper force analysis & gripper design, active & passive grippers, artificial intelligence & automated manufacturing,AI&robotics,need for sensing systems, sensory devices, types of sensors, robot vision systems.

UNIT III **(6 hours)**

Control of robotic actuators: the effect of friction & gravity-modelling the DC servomotor,final position with no friction or gravity disturbance,final position with nonzero friction and /or gravity disturbance,contol of robotics joint- digital position & analog velocity – separate sensors,measured digital position & derived digital velocity – single sensors, measured analog velocity & derived analog position- single sensors, measured analog position & derived analog velocity – single sensor ,adaptive control , optimal control, servo amplifiers-linear servo amplifier, pulse width modulated amplifier, effect of feedback in servo amplifier- voltage amplifier driving servo motor, current amplifier driving servo motor, current & voltage feedback amplifier driving servo motor.

SECTION II

UNIT IV (8 hours)

Low level Vision: introduction, image acquisition, illumination techniques, imaging geometry, basic relationships between pixels, preprocessing

UNIT V(4 hours)

Robot Programing languages: introduction, characteristics of robot-level languages, characteristics of task-level languages,.

UNIT VI **(6 hours)**

Robot intelligence & task planning:introduction, state space search, problem reduction, use of predicate logic, means-ends analysis, problem-solving, robot learning, robot task planning, basic problem in task planning, expert system and knowledge engineering.

UNIT VII **(2 hours)**

Robotic Applications: -welding, spray painting, grinding, other applications involving a rotary tool, parts handling/ transfer, assembly operations, parts sorting, parts inspection, robot application in the future.

TERM WORK

Term work based on 8-10 Tutorials on above topics.

REFERENCE BOOKS:

1) Robotics by K.S.Fu, R.C.Gonzalez, C.S.G.Lee
2) Robotic engg. By R.D.Klafter, T.A.Chmielewski, Michael Negin
3) Robotic Technology By S.R.DEB

SEMISTER – VII
05. Electrical System Modeling
(Elective-I)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTION I

UNIT I (8 hours)

Modeling of synchronous machines I: Basic models, electrical equations, mechanicalequations, per unit system and normalization, parks transformation, flux linkages equationsvoltage and current equations.

UNIT II (8 hours)

Modeling of synchronous machines II: Formulation of state-space equations, equivalentcircuit sub transient and transient inductances and time constants, simplified model ofsynchronous machines, steady state equations and phasor diagram, determination of machines Parameters from manufactures data.

UNIT III (8 hours)

Excitation system modeling: Modeling of excitation system components, modeling ofcomplete excitation system.

SECTION II

UNIT IV (8 hours)

Modeling of induction motors I: Circuit model of a three phase induction motor, lineartransformation, phase transformation, transformation to a reference frame, and two axis models
for induction motor.

UNIT V (8 hours)

Modeling of induction motors II: Voltage and current Equations in stator reference frame,equation in rotor reference frame, equations in a synchronously rotating frame, torque equation.

UNIT VI (8 hours)

Line and load modeling: Transformer model, transformer with nominal turns ratio, threewinding transformers model, phase shifting transformers, load modeling, constant currentmodel, constant impedance model, constant power model, composite load, dynamiccharacteristics, static load modeling for load flow studies, voltage dependence of equivalentloads, derivation for equivalent load powers.

REFERENCE BOOKS:

1. P. S. Bimbhra, “Generalized theory of electrical machines”, Khanna Publishers
2. PSR Murty, “Modeling of power system components”, BS Publications
3. P. M. Anderson and A. A. Fouad, “Power System control and stability”, Wiley-India Edition
4. Paul C. Krause, Oleg Wasynezuk, Scott D. Sudhoff, “Analysis of Electric Machinery”, IEEE Press, 1995

5. PrabhaKundur, Neal J. Balu, Mark G. Lauby, “Power System Stability and Control”, Tata McGraw Hill Publishing Co. Ltd.
6. VedamSubramanyam, “Thyristor control of Electric Drives”

SEMISTER – VII
05. NEURAL NETWORK &FUZZY LOGIC
(Elective-I)

Teaching Scheme:	Examination Scheme:
Lectures: 04 Hours/Week	Paper: 100 Marks
Tutorials: 01 Hours/Week	T.W.: 25 Marks

SECTION I

UNIT I (6 hours)

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Operation of Artificial Neuron, Types of Neuron Activation Function, Characteristics of ANN, McCulloch-Pitts Model, Potential Applications of ANN.

UNIT II (8 hours)

Essentials of Artificial Neural Networks : ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy, Learning rules,Perceptrons models, Discrete continues and Multi category.

Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

UNIT III (10 hours)

Feed Forward Neural Networks& Associative Memory: Introduction, Generalized Delta Rule, Derivation of Back-propagation (BP) Training, Back-propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements,Paradigms of Associative Memory,Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules,Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm,Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm.

SECTION II

UNIT IV (10 hours)

Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Theory of Approximate reasoning: Linguistic variables, Fuzzy proportions, Fuzzy IF- THEN statements, Inference Rules, Compositional rule of inferences

Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods

UNIT V (8 hours)

Non-Liner Fuzzy Control:-FKBC as a Linear Transient element, PID like FKBC, Sliding mode FKBC, Sugeno FKBC.

Basic concept, Structure of FKBC, Choice of Membership Functions, Scaling Factors, Rules, Fuzzification&Defuzzification procedures.

UNIT VI (6 hours)

Applications: Neural network applications: Process identification, control, fault diagnosis and load forecasting.

Fuzzy logic applications: Fuzzy logic control and Fuzzy classification

REFERENCE BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Neural Networks Using Matlab 6.0, S. N. Sivanandam, S. N. Deepa, Tata McGraw-Hill Education, 2006
3. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997
4. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. BapiRaju, Pearson Education
5. Neural Networks – Simon Hykins , Pearson Education
6. Neural Networks and Fuzzy Logic System by Bork Kosk, PHI Publications.
7. Fuzzy Logic with Engineering applications: Timoty Ross, John Wiley,Second Edition, 2009.
8. Fuzzy Sets & Fuzzy Logic Theory & Applications: Klir, Yuan, PHI, 2009

SEMISTER – VII
05. NONLINEAR & DIGITAL CONTROL SYSTEM
(Elective-I)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTION I

UNIT – I :Linear Algebra 8

Subspaces, Linear independence, Basis, Dimension of a vector space. Linear transformation – Matrix as a linear transformation, Linear Operators - Null space and Range Matrix Operators – Operator Algebra – Change of Basis and similar Matrices. Definition and examples – Norm: Angle between vectors –Orthogonal bases, Gram-Schmdit process, QR decomposition – Best approximation and Least squares – Orthogonal matrices.

UNIT – II: LINEARIZATION PROCESS 8

Common Nonlinear behavior, Common Nonlinearities - Autonomy - Equilibrium points of nonlinear systems, Feedback Linearization, Series Approximation Methods. Describing function for different nonlinearities - ideal relay, hysteresis, dead zone, saturation - Stability analysis of systems by describing function - Stable and unstable limit cycle - Dual Input Describing Function - DIDF for typical nonlinearities .

UNIT –III:PHASE PLANE ANALYSIS 8

Singular points - Construction of phase plane using Isocline, Lienard, Delta and Pell's methods - Poincare index and Bendixon theorems-Stability, determination - Limit cycles -Nonlinear performance analysis of piecewise linear system.

SECTION II

UNIT –IV: STABILITY ANALYSIS 10

Lyapunov direct method, positive definite functions and lyapunov functions, invariant set theorems, lyapunov analysis of linear time invariant systems, the variable gradient method, performance analysis, control design based on lyapunov's direct method, Lyapunov analysis of non autonomous systems, existence of Lyapunov functions. Lyapunov Stability, On - Off Control System: Solution of equation - Relay with lead circuit - Popov method - Generation of Liapunov function - Gradient, Lure and Krasoviski method.

UNIT- VI:SLIDING MODE CONTROL 8

Variable structure systems - Basic concepts - Sliding modes in variable structure system conditions for existence of sliding regions – Case Study - Sliding mode approach to speed control of dc motors.

Text & Reference Book

1. John E Gibson, “Non linear Automatic Control”, McGraw Hill Inc., 1963.
   J.E.Slotine and W.Li Applied Nonlinear control, Prentice Hall, 1998
2. Sankar Sastry, Nonlinear Systems Analysis, Stability and Control.
3. M. Vidyasagar, Nonlinear Systems Analysis, Prentice - Hall International editions,1993.
4. Hasen K Khalil, "Nonlinear Systems", Prentice Hall Inc., New York, 1996.
5. M Gopal, “Digital Control and State Variable Methods, Conventional and Intelligent Control Systems”, McGraw-Hill Inc., New Delhi, Third Edition, 2009.
6. R. Marino and P. Tomei Nonlinear control design - Geometric, Adaptive and Robust, Prentice Hall,1995
7. Alberto Isidori Non linear Control systems, Springer Verlag, , 1999

SEMISTER – VII
06. PORJECT-I

Teaching Scheme:
Practical: 02 Hours/Week

Examination Scheme:
T.W.: 50 Marks
POE: 50 Marks

Term work:

The project work is to be carried out in two semesters of B.E. (Electrical and Electronics Engineering) Part – I & Part– II. The practical batch for project will be of 15 students. The batch will be preferably divided into groups each consisting of not more than 3 students. In semester – I, group will select a project with the approval of the guide and submit the synopsis of project in the month of August. The group is expected to complete details of system design, layout etc. in semester – I, as a part of term work in the form of a joint report. In addition all students of project group will deliver the seminar on the proposed project only. If the group of student select a project under sponsored category from industry, it is essential that they should take prior written permission & approval at the beginning of semester-I from Head of Institution through Head of Department & Concerned Guide.

SEMESTER – VIII

01. ELECTRICAL MACHINE DESIGN

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week
Practical: 02 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
POE: 50 Marks

SECTION I

UNIT I (8 hours)

General: ISI specifications for conductors, Transformer, transformer oil and induction motors. Standard specifications for rotating electrical machinery as per IEC publications. Temperature Rise Calculations and Measurement Sources and position of heat generation, Solid body heating, Heating and cooling processes. Calculation of steady temperature rise of induction motor armature and transformer core. Machine ratings based on thermal considerations, typical temperature gradients in transformers and three phase induction motors, Methods of measuring temperature in Electrical machines.

UNIT II& III (16 hours)

Design of Transformers: Output equation for single and 3 phase transformer, Choice of specific loading, Expression for volt per turn, Determination of main dimension of the core, Types of winding 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 & Rectangular)

SECTION II

UNIT IV (8 hours)

Design of DC Machines: Output equation, Choice of Specific loading and Choice of No. of Poles, Design of main dimensions of D.C. machines, Design of armature and slot dimensions, Commutator & Brushes.

Magnetic circuit:- Estimation of Amp-turns, Design of Yoke & Poles- main and interpoles, Field Winding- Shunt , Series & inter poles.

UNIT V& VI (16 hours)

Design of Induction Motors:
Output equation, Choice of Specific loading, main dimensions of three phase induction motor, stator winding design, choice of length of air gap, estimation of number of slots for squirrel cage

rotor, design of rotor bars and end rings, design of slip-ring induction motor, estimation of no load current and leakage reactance, circle diagram

TERM WORK:
Ten laboratory exercises consist of minimum 04 exercises using AUTOCAD.

REFERENCE BOOKS

1. A Course in Electrical Machine Design A. K. Sawhney, DhanpatRai.
2. Principles of Electrical Machine Design, R. K. Aggarwal, S. K. Kataria& Sons.
3. Electrical MacHine Design - the Design and Specification of Direct and Alternating Current MacHinery,Alexander Gray
4. Electrical Machine Design Data Book, A. Shanmugasundaram, R. Palani,New Age International
5. Sen, S.K, "Principles of Electric Machine Design with Computer Programmes", Oxford & IBH Publishing Company Private Limited, 2001, Reprint 2004.
6. Agarwal R.K., "Principles of Electrical Machine Design", S.K.Kataria and Sons, New Delhi, 2002.
7. Shanmugasundaram, A., Gangadharan G. and Palani R., "Electrical Machine Design Data Book", New Age International Publishers Private Limited., 1st Edition 1979, Reprint 2005.

SEMESTER – VIII

02. UTILIZATION & ENERGY CONSERVATION

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week
Practical: 02 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 50 Marks

SECTION I

UNIT I (8 hours)

Electric traction: DC, AC and composite traction systems, main line and suburban systems, Comparison with Diesel-Electric traction, traction equipment, Trolley wire, catenaries,Feeding and distribution systems, negative booster, overhead lines, current collectors,traction substations.

UNIT II (8 hours)

Train movement and Energy consumption: Trapezoidal and quadrilateral speed-timecurves, Maximum, average and scheduled speeds, Mechanics of train movement, tractiveeffort calculation, Power and energy output from driving axles, Specific Energy Output.

UNIT III (8 hours)

Traction motors and their Control :D.C. series, A.C. series and 3 Phase Induction motorsfor traction, Brief introduction to rheostatic speed control methods, drum controller, MultipleUnit Control, Static control of traction morors. Use of microprocessors for control of tractionmotors.

SECTION II

UNIT IV (8 hours)

Braking of traction motors: Vacuum brake and Air brake systems, regenerative braking, calculation of energy returned during regenerative braking.

UNIT V (8 hours)

Electric Drives: Classes of insulation, Heating and cooling curves, derivation of heatingand cooling time constants, Load equalization, flywheel calculations, capitalization of losses and selection of most economical motor.

UNIT VI (8 hours)

Electric Heating and Welding: Classification of electric heating, heating methods, Resistance heating, design of heating element, Arc furnaces, induction heating, Induction furnaces, Dielectric heating, Electric arc welding, welding transformer, Power supply and control of electric welding, Laser beam welding.

REFERENCE BOOKS:

1. Utilization of Electric Power and Electric Traction: J.B. Gupta, 8^{th} Edition
2. Art and science of Utilization of Electric Energy: H. Partab
3. A course in Electrical Power: Soni, Gupta and Bhatnagar
4. Utilization of Electric Energy: Openshaw Taylor
5. Electrical Power : S. L. Uppal

SEMESTER – VIII
03. EMBEDDED SYSTEMS

Teaching Scheme:	Examination Scheme:
Lectures: 04 Hours/Week	Paper: 100 Marks
Tutorials: 01 Hours/Week	T.W.: 25 Marks
Practical: 02 Hours/Week	POE: 25 Marks

SECTIONI

UNIT I (6hours)

ARM ARCHITECTURE INTRODUCTION: Embedded System hardware,registers, CPSR, Pipeline, Exceptions, Interrupts & the vector Table, Core Extensions, Introduction to Instruction Set with examples : Data processing, Branch, Load-store, S/w interrupts, program status Register Instructions, loading constants.(assembly language programming is not expected)

UNIT II(10hours)

LPC21xx Series (Case study LPC2148): Study of Architecture, memory organization and on chip resourses – I/O ports, serial port , ADC, RTC, SPI, I2C, Timers, CCP Modules.

UNIT III (8hours)

Programming in C: Introduction to embedded C , Data types, memory access , Branching and looping Statements. Handling LPC 2148 peripherals using C (S/W and H/W Programs are expected)

SECTION II

UNIT IV (6 hours)

Introduction to RTOS: Introduction to RTOS concept, embedded software architectures: Round robin, round robin with interrupts, Function queue scheduling and real time operating system, Tasks and task states, Task scheduling, shared data and reentrancy, semaphores and shared data using semaphores, protecting shared data.

UNIT V(8hours)

Introduction To PLC: Basic Components and their Symbols, Fundamentals of Ladder Diagrams, Machine Control terminology, PLC configurations, System Block diagram, Physical components Vs Program components

UNIT VI (8 hours)

Closed-loop, PID & MOTOR Control : Simple Closed-loop Systems, Problems with Simple Closed-Loop Systems, Closed-Loop Systems using Proportional, integral, derivative

(PID), The PID in programmable Logic controllers, Tuning the PID, Auto tuning PID systems, AC motor starter, DC Motor Controller

TEXT BOOKS:

1. An Embedded Software Primer, David E. Simon Pearson Education, Asia Publication
2. ARM System Developers Guide Designing & Optimizing System Software By Andrew N, Dominic Sloss, and Chris Wright.
3. Programmable Logic controllers, John W. Webb, Ronald A. Reis.
4. Philips LPC 21xx user manual

REFERENCE BOOKS:

1. Embedded/ Real-Time Systems: Concepts, Design & Programming By Dr. k V K K Prasad, Dreamtech Press
2. Programmable Logic controllers, John r. Hackworth, Frederick D. Hackworth Jr.
3. Philips LPC 2148 data sheet

LIST OF EXPERIMENTS:

Total 10 expt. should be conducted. 5-from LPC 2148 & C Programming & 5-from PLC.Best on following guidelines.

1. Port operation
2. LCD interfacing
3. Timers
4. PLL/PWM
5. ADC/DAC
6. Simple Ladder programs
7. Star delta starter
8. PID controller and implementation ex. Temp. controller
9. Interlocked Logic operation

SEMESTER – VIII
04. HVDC
(Elective-II)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTIONI

UNIT I (8 hours)

BASIC CONCEPTS
Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT II (8 hours)

ANALYSIS OF HVDC CONVERTERS: Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

UNIT III(8 hours)

CONVERTER & HVDC SYSTEM CONTROL
Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

SECTION II

UNIT IV (8 hours)

REACTIVE POWER CONTROL IN HVDC
Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategiessources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT V(8 hours)

CONVERTER FAULT & PROTECTION
Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

UNIT VI(8 hours)

HARMONICS& FILTERS

Generation of Harmonics –Characteristics harmonics,calculation of AC Harmonics,Non-Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics.Types of AC filters,Design of Single tuned filters –Design of High pass filters.

REFERENCE BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.
3. HVDC Transmission – J.Arrillaga.
4. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
5. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.

SEMESTER – VIII
04. POWER SYSTEM HARMONICS
(Elective-II)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTIONI

UNIT I (8 hours)
Introduction: Understanding Power quality, Definitions, Growing concerns to PQ, Evaluation procedure, General classes of PQ disturbances, Causes and effects of power quality disturbances.

UNIT II (8 hours)
Voltage sags and Interruptions: causes and effects, estimation of voltage sag performance, principle of protection and solutions.

UNIT III (8 hours)
Transient overvoltages: Sources causes and effects, Principle of Overvoltage protection, solutions.

SECTION II

UNIT IV (8 hours)
Long duration voltage variations: Principle of regulating voltage, devices for voltage regulation, flicker, flicker sources and mitigation, quantifying flicker.

UNIT V (8 hours)
Harmonics: Harmonic distortion, Harmonic sources, effect of HD, voltage V/s current harmonics, active, reactive, voltamp power under non sinusoidal condition, harmonic indices (THD, TDD), Principles for controlling Harmonics, devices controlling Harmonics.

UNIT VI (8 hours)
Power Quality Monitoring: Monitoring considerations, site survey, monitoring quantity, monitor location, PQ measuring instruments, assessment of PQ measurement data, IEEE 1159 standard.

REFERENCES BOOKS:
1. Power Quality – R.C. Duggan
2. Power system harmonics –A.J. Arrillga
3. IEEE std. 519, 1159.

SEMESTER – VIII
05. ELECTRICAL AND ELECTRONIC MATERIALS
(Elective-II)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTION I

UNIT I (4 hours)

Classification:

Classification of material into conducting, semi conducting and insulating materials through a brief reference to their atomic structures and energy bands

UNIT II (10 hours)

Conducting Materials:

Introduction, Resistance and factors affecting it such as alloying and temperature etc, superconductor , Classification of conducting material as low resistivity and high resistivity materials, Low resistance materials , Copper: Its general properties as conductor, resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electricalengineering.Aluminum,Steel. Introduction to handle conductors and its applications. Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications with reasons for the same. Applications of special metals e.g. Silver, Gold, Platinum etc. High resistivity materials and their applications e.g., manganin, constantin, Nichrome, mercury, platinum, carbon and tungsten, Superconductors and their applications

UNIT III (8 hours)

Semi-conducting Materials:

Introduction, Semi-conductors and their properties, Different semi-conducting materials (silicon and germanium) used in manufacture of various semiconductor devices (i.e p-type and n-type semiconductors) Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.

SECTION II

UNIT IV(8 hours)

Insulating materials; General Properties:

Electrical Properties: Volume resistivity, surface resistance, dielectric loss, dielectric strength(breakdown voltage) dielectric constant , Physical Properties: Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness ,Thermal Properties: Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics , Chemical Properties: Solubility, chemical resistance, weather ability , Mechanical properties, mechanical structure, tensile structure

UNIT V (8 hours)

Applications of Insulating Materials:

Plastics ,Definition and classification, Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Melamine-formaldehyde), epoxy resins - their important properties and applications , Thermo-plastic materials: Polyvinyl chloride (PVC), polyethylene, silicons, their important properties and applications , Natural insulating materials, properties and their applications, Gaseous materials; Air, Hydrogen, Nitrogen, SF6 their properties and applications

UNIT VI (10 hours)

Magnetic Materials:

Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, and hysteresis loop (including) coercive force and residual magnetism, concept of eddy current and hysteresis loss, Curie temperature, magnetostriction effect. Soft Magnetic Materials: Alloyed steels with silicon, high silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines , Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine , Nickel-iron alloys ,Soft Ferrites, Hard magnetic materials, Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications.

Special Materials:

Thermocouple, bimetals, leads soldering and fuses material, mention their applications

Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc

REFERENCE BOOKS:

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
2. Electronic Components and Materials by Grover and Jamwal, DhanpatRai and Co., New Delhi
3. Electrical Engineering Materials by Sahdev, Unique International Publications
4. Electronic Components and Materials by SM Dhir, Tata McGraw Hill, New Delhi
5. Electronic Engineering Materials by ML Gupta, DhanpatRai& Sons, New Delhi
6. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
7. Electrical & Electronics Engineering Materials BR Sharma and Others, SatyaParkashan

SEMESTER – VIII
04. VLSI DESIGN
(Elective-II)

Teaching Scheme:
Lectures: 04 Hours/Week
Tutorials: 01 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

SECTION I

UNIT I(8 hours)

INTRODUCTION: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS &BiCMOStechnologies- Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors.

UNIT II(6 hours)

BASIC ELECTRICAL PROPERTIES: Basic Electrical Properties of MOS and BiCMOS Circuits:I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, gm, gds, figure of merit ωo; Pass transistor,NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT III(8 hours)

GATE LEVEL DESIGN: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits,Basic circuit concepts

SECTION II

UNIT IV(8 hours)

VHDL SYNTHESIS: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout,Design capture tools, Design Verification Tools, Test Principles.
Elements of VHDL: Entity, Architecture, Library, Package, Configurations, Data types and operators

UNIT V(8 hours)

SUBSYSTEM DESIGN: Design of, Adders, ALUs, Multipliers, Parity generators,Comparators, Zero/One Detectors, Shifters, Counters, High Density Memory Elements.

UNIT VI (6 hours)

SEMICONDUCTOR INTEGRATED CIRCUIT DESIGN: Architecture ofPLAs, PALs, FPGAs, CPLDs, Standard Cells and their Design Approach.

Text Books:

1. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.
2. VHDL a design oriented approach- S. S. Limaye,TATAMcgrawhill Companies

REFERENCE BOOKS:

1. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
3. Fundamentals of Digital logic design with VHDL – Stephen Brown &ZvonkoVranesic

SEMISTER – VIII
06. PORJECT-II

Teaching Scheme:
Practical: 04 Hours/Week

Examination Scheme:
T.W.: 100 Marks
POE: 100 Marks

Term work

The Project group in semester-I will continue. the project work in Semester- II and complete project in all respect (assembly, testing, fabrication, tabulation, test result etc.) The project work along with project report should be submitted as part of term work in Semester- II on or before the last day of the semester -II. The Term work marks of the project-II will be based on mid-term evaluation by team of faculties along with the concerned Guide