SEMESTER VI

Si.No	Code	Title	L	T	P	C	Category
1	EE3005	Digital Signal Processing	3	-	-	3	PT
2	EE3006	Power Systems - II	3	-	-	3	PT
3	EE3007	Power Electronics	3	-	-	3	PT
4		Elective - 3	3	-	-	3	PT
5		Elective - 4	3	-	-	3	PT
6	EE3008	Environmental Studies for Electrical Engineers	3	-	-	3	OT
7	EE3092	Electrical Machines Lab - II	-	-	3	2	PT
8	EE3093	Mini Project	-	-	3	2	PR
			18	**-**	**6**	**22**	**6**

LIST OF ELECTIVES – VITH SEMESTER

Sl. No	Code	Title	Credits
1	EE3031	Dynamic System Simulation	3
2	EE3032	Digital Control Systems	3
3	EE3033	Fuzzy Logic Systems	3
4	EE3034	Electrical Machine Design	3
5	EE3035	Biomedical Instrumentation	3
6	EE3036	Illumination Engineering	3
7	EE3037	Analog Filters	3
8	EE3038	Power Semiconductor Devices	3
9	EE3039	Advanced Processor Architecture and System Organization	3
10	EE3040	LT & HT Distribution Systems	3
11	EE3041	DC Drives	3
12	EE3042	Electrical System Design for Buildings	3

BRIEF SYLLABI

EE3005 DIGITAL SIGNAL PROCESSING

Pre-requisites: EE2001 Signals & Systems

L	T	P	C
3	0	0	3

Discrete-time signals and systems- linear shift - invariant systems – Properties of systems- representations- z transform and inverse z transforms; Transform Analysis of LTI Systems and Structures for DTS - Geometric construction for computation of the frequency response function from pole-zero plots- Linear systems with generalized linear phase- - basic structures for IIR and FIR systems; Digital filter design techniques and finite word length effects- Design of IIR and FIR filters- zero input limit cycles- Limit cycles due to overflow; The Discrete Fourier Transform - Representation of periodic sequences- linear convolution using DFT- FFT algorithms- DFT analysis of sinusoidal signals.

Total Hrs : 42 Hrs

EE3006 POWER SYSTEMS - II

Pre-requisites : None

L	T	P	C
3	0	0	3

Performance of transmission lines-Representation of power systems- load flow studies- HVDC Transmission and AC-DC load flow -Short circuit studies- Economic dispatch of thermal plants- implementation of Economic Dispatch and Automatic Generation Control- Introduction to deregulated power systems Power system stability studies.

Total Hrs: 42 Hrs

EE3007 POWER ELECTRONICS

Prerequisite: Nil

L	T	P	C
3	0	0	3

Power diodes - thyristors - gate triggering circuits - commutation circuits – IGBTs – MOSFETs - Controlled rectifiers using SCR - series, parallel and bridge inverters – PWM inverters - AC regulators - Cycloconverters - choppers - switching regulators - switched mode power supply - uninterruptible power supply units.

Total Hrs: 42 Hrs

EE3008 ENVIRONMENTAL STUDIES FOR ELECTRICAL ENGINEERS

Pre-requisites: None

L	T	P	C
3	0	0	3

Renewable and non-renewable resources - forest resources - use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forest and tribal people - water resources - use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems - mineral resources - use and exploitation- environmental effects of extracting and using mineral resources, case studies- ecosystems - concept of an ecosystem - structure and function of an ecosystem introduction – definition - genetic, species and ecosystem diversity - bio geographical classification of India - environmental pollution - social issues and the environment - human population and the environment - population growth- variation among nations. - population explosion – family welfare program - field work

Total Hrs: 42 Hrs

EE 3031 DYNAMIC SYSTEM SIMULATION

Prerequisite: EE2001 Signals & Systems

L	T	P	C
3	0	0	3

Simulation of systems using Computers: Study of popular Simulation Tools- Text based programming-Integrated Programming Environments-Case studies for typical systems.

Blockset based simulation techniques- Case studies for typical systems- Simulation of Power Electronic Circuits, Machines and Drives- Circuit Simulation and Systems Simulation approaches-Development of generalized machine models for induction motor. -

Introduction to Random Processes and Stochastic Systems Theory

Total Hrs: 42 Hrs

EE3032 DIGITAL CONTROL SYSTEMS

Pre-requisite: EE3002 Control Systems I

L	T	P	C
3	0	0	3

Basic digital control system-Sample and Hold-Mapping between s-domain and z-domain-Principles of discretisation- Pulse transfer function- Modified z-transform- Multi-rate discrete data systems-Steady state performance- Jury's stability test – Robustness and sensitivity-Root locus- Polar plots-Nyquist stability criterion-Bode plot- Bilinear transformation method and Routh stability criterion on the r-plane – Design of compensators using root locus and bilinear transformation-Design of PID controllers- Dead-beat response design- State variable model of discrete data systems - Controllability, Observability, stability and reachability- Loss of controllability and observability due to sampling -Pole placement design using state feedback for SISO systems-Computer based simulation.

Total Hrs: 42 Hrs

EE 3033 FUZZY LOGIC SYSTEMS

Pre-requisite: None

L	T	P	C
3	0	0	3

Theory of Fuzzy Sets and fuzzy relations: Fuzzification and De-fuzzification : Formation of Fuzzy Rule Base-defuzzification methods -Fuzzy Logic : fuzzy rule based systems - approximate reasoning - canonical rule forms - decomposition of compound rules - fuzzy inference systems- Mamdani and Takagi-Sugeno fuzzy models- fuzzy control models-P-1-D like fuzzy control rules – implementation. Computer based simulation-Language based programming in C/C++-Use of Simulation Tools -Fuzzy nonlinear simulation- fuzzy classification - clustering – fuzzy pattern recognition - fuzzy control systems- fuzzy optimization - case studies – Fuzzy Logic combined with Neural Networks and Genetic Algorithms-Soft Computing Techniques- Fuzzy measures (brief introduction only).

Total Hrs: 42 Hrs

EE3034 ELECTRICAL MACHINE DESIGN

Prerequisite: EE2007 Electrical Machines I & EE3003 Electrical Machines II

L	T	P	C
3	0	0	3

DC machines - output equation - main dimensions - choice of specific loadings, speed and number of poles - design of various parts - Carter's coefficient - design examples - Transformers - output equation of single phase and three phase power transformers - main dimensions - choice of specific loadings - design of various parts -

prediction of various quantities and equivalent circuit based on design data - design examples - alternators - output equation of salient pole and turbo alternators - main dimensions - choice of specific loadings, speed and number of poles - design of various parts - prediction of regulation and the characteristics based on design data - design examples - induction machines - output equation - main dimensions - choice of specific loadings - design of various parts - prediction of various quantities and equivalent circuit based on design data - design examples.
Total Hrs : 42 Hrs

EE 3035 BIOMEDICAL INSTRUMENTATION

Pre-requisites : None

L	T	P	C
3	0	0	3

Introduction to electrophysiology – action potential – transducers for biomedical - heart and cardiovascular system –blood pressure measurement - plethysmography - heart lung machine - ECG – Eindhoven 's law - 12 lead system – cardiac pace maker –defibrillator -EMG – introduction to nervous system and brain -EEG –

Introduction to intensive care monitoring –patient monitoring instruments –organization of hospital for patient care monitoring – respiratory physiology – measurements in respiratory system –respiratory therapy equipments – instrumentation for sensory measurement and behavioral studies – ultrasonics in medicine

Lasers in medicine - X ray and radio isotopes – radio therapy equipment -safety and dosage

Renal physiology

Total Hrs : 42 Hrs

EE3036 ILLUMINATION ENGINEERING

Pre-requisites : None

L	T	P	C
3	0	0	3

Need for good Illumination, Radiation, Eye and Vision , Laws of Illumination, Electric light sources and their operating characteristics, Entities in the illumination systems and their units, measurement of illumination- determination of total luminous flux emitted by different sources, Design of lighting systems- Interior Lighting -Sports Lighting -Road Lighting -Street lighting-Factory outdoor lighting- Flood lighting, Maintenance of lighting system and Lighting Calculations considering day light. Design of Energy efficient lighting systems.

Total Hrs : 42 Hrs

EE3037 ANALOG FILTERS

Pre-requisites: EE2001 Signals & Systems, EE2004 Basic Electronic Circuits,

EE2005 Circuits & Networks, EE2008 Analog Electronic Circuits & Systems

L	T	P	C
3	0	0	3

Review of continuous time LTI systems – Categories of Filters- The Filter approximation problem: - Butterworth Approximation- Chebyshev and Inverse Chebyshev Approximations- Elliptic Approximation- Bessel approximation- Phase and Group delay characteristics of approximation functions-delay equalizer functions

Passive filters -Higher order filters- network functions-synthesis of higher order passive filters. Singly and doubly terminated LC ladders. Limitations of Passive filters

Active Filters Single OPAMP Biquads - Analysis and design of LP, HP and BP Filter with second order response. Sensitivity Analysis of Single OPAMP Filters. Analysis and design of various multiple OPAMP filters – Compensation -Inductor Simulation, Antoniou Gyrators, LP,HP,BP and BE Filters using Antoniou

Gyrators. -Structure for LP, HP, BP and BE SC Filters, Basic ideas of method of realization of higher order filters. Synthesis of LC ladder Networks using gyrators

Total Hrs : 42 Hrs

EE3038: POWER SEMICONDUCTOR DEVICES

Pre-requisite: None

L	T	P	C
3	0	0	3

Power Diode: Basic Structure and I-V Characteristics. Thyristor: Basic Structure . V-I Characteristics. DIAC: Basic Structure and operation . V-I Characteristics . Ratings TRIAC: Basic Structure and operation . V-I Characteristics . Ratings . Snubber Requirements. Gate Turnoff Thyristor (GTO): Basic Structure and Operation Power BJT: Basic Structure and I-V Characteristics . Power MOSFET: Basic Structure . V-I Characteristics Insulated Gate Bipolar Junction Transistor (IGBT): Basic Structure and Operation.

Total Hrs: 42 Hrs

EE3039 ADVANCED PROCESSOR ARCHITECTURE & SYSTEM ORGANISATION

Pre-requisites: EE3001 Microprocessors & Microcontrollers

L	T	P	C
3	0	0	3

Basics of Computer System – Micro Controllers – Introduction to different manufacture's microcontrollers – dsPIC as a tool to learn modern microcontrollers – Simulation using MPLAB IDE – Applications – Relay, Keyboard, LED / LCD display interfacing – Motor Control – Measurement systems.

Total Hrs : 42 Hrs

EE3040 LT & HT DISTRIBUTION SYSTEMS

Pre-requisites : None

Power system-general concepts, Load and Energy forecasting, Power system analysis, Optimization of distribution system-network cost modeling-economic loading of distribution transformers. Distribution system reliability, Consumer services, Tariffs-costing and pricing, Overhead and underground lines-optimum design considerations, Power capacitors - HT and LT capacitor installation requirements, Distribution System Design, Electrical Safety and Earthing Practices, Lightning protection, Distribution Automation System -SCADA systems and Automation

Total Hrs : 42 Hrs

EE3041 DC DRIVES

Prerequisite: EE3007 Power Electronics

L	T	P	C
3	0	0	3

Introduction to Drives – Modelling of DC machines - Theory of operation – Induced EMF – Equivalent circuit and electromagnetic torque – Elecrtomechanical modeling – state space modeling – Phase controlled DC motor Drives - Field Control – Armature Control – Steady state analysis of Three phase converter controlled DC motor drive – DC motor drive with field weakening. Harmonics and Associated problems – Effect of field weakening - Chopper Controlled DC motor Drive - Steady state analysis of chopper controlled DC motor drive- Torque pulsations.

Total Hrs : 42 Hrs

EE3042 ELECTRICAL SYSTEM DESIGN FOR BUILDINGS

Pre-requisites : None

L	T	P	C
3	0	0	3

Electrical Installations: general requirements, design considerations, testing, estimating and costing - design of panel boards – design and estimation of service connections – design and safety aspects of residential buildings- Illumination schemes- design of lighting for various purposes- Electrical system design, estimation and costing of commercial buildings, hospitals, recreational and assembly buildings, cinema theatres, small industries, substations- Design of earthing system.

Total Hrs: 42 Hrs

EE3092 ELECTRICAL MACHINES LAB II

Prerequisite: EE3003 Electrical Machines II

L	T	P	C
0	0	3	2

No-load and Blocked-Rotor tests and load tests on Three-phase and Single-phase Induction Motors, Speed control of Induction Motor, Regulation studies on Salient Pole and Non-Salient Pole Synchronous Machines, Synchronisation and V-Curves of a Synchronous Machine

Total Hrs : 42 Hrs

DETAILED SYLLABI

EE3005 DIGITAL SIGNAL PROCESSING

Pre-requisites: EE2001 Signals & Systems

L	T	P	C
3	0	0	3

Total Hrs : 42 Hrs

Module 1: **(10 Hrs)**

Discrete-time signals and systems: Discrete-time signals - sequences - Discrete-time systems- linear shift - invariant systems - stability and causality - difference equations - frequency domain representations – Review of Fourier transform and its properties - sampling of continuous - time signals – Spectral characteristics - z transform - inverse z transforms .

Module 2: **(10 Hrs)**

Transform Analysis of LTI Systems and Structures for DTS: Frequency response for rational system functions- Geometric construction for computation of the frequency response function from pole-zero plots- All pass systems-minimum phase systems-Linear systems with generalized linear phase characteristics- basic structures for IIR and FIR systems- Direct forms- cascade forms- parallel forms.

Module 3: **(12 Hrs)**

Digital filter design techniques and finite wordlength effects: Design of IIR filters from analog filters - analog Butterworth function for various frequency selective filters- analog to digital transformation - backward - difference and forward - difference approximations - impulse invariant transformation - bilinear transformation - prewarping - design examples - properties of FIR filters - design of FIR filters using windows - comparison of IIR and FIR filters - finite word length effect in DSP- zero-input limit cycles in fixed point realizations of IIR digital filters-Limit cycles due to overflow.

Module 4: **(10 Hrs)**

The Discrete Fourier Transform : Representation of periodic sequences - properties of discrete Fourier series - discrete Fourier transforms - properties of DFT - linear convolution using DFT - overlap - add method - overlap - save method - FFT - Radix2 DIT FFT algorithm - Radix2 DIF FFT algorithm - butterfly structure - bit reversed order - in - place computations-Fourier analysis of signals using the DFT .

Text/Reference Books:

1. Alan V . Oppenheim, Ronald W. Schafer, .Discrete-Time Signal Processing., Prentice-Hall of India Pvt. Ltd., New Delhi, 1997
2. Sanjit K Mitra, .Digital Signal Processing: A computer-based approach. ,Tata McGrow-Hill edition .1998
3. John G. Proakis, and Dimitris G. Manolakis, .Digital Signal Processing.(Fourth Edition), Pearson Prentice Hall of India Pvt. Ltd, New Delhi, 2007
4. Emmanuel C. Ifeachor, Barrie W. Jervis , .Digital Signal Processing-A practical Approach., Addison Wesley Publishers Ltd.,1993
5. Abraham Peled and Bede Liu, Digital Signal Processing ,Theory, Design and Implementation, John Wiley and Sons,Inc., 1976
6. Haykin and Van Veen, Signals and Systems, (second edition), John Wiley and sons, Inc.,2003.

EE3006 POWER SYSTEMS - II

Pre-requisites : None

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Module 1: **(12 Hrs)**

Performance of transmission lines - calculation of transmission line inductance and capacitance - GMD and GMR - bundled conductors - transposition - ABCD constants - effect of capacitance - nominal T and π methods of calculations -power flow through a transmission line. Methods of voltage control

Representation of power systems - per unit quantities - Y-bus and Z-bus matrices - load flow studies:-Gauss-Seidal- Newton Raphson and fast decoupled methods - line loss computation – HVDC Transmission and AC-DC load flow

Module 2: **(10 Hrs)**

Short circuit studies - faults on power systems - short circuit capacity of a bus and circuit breaker ratings-current limiting reactor- sequence impedances and sequence network - symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator – Z bus building algorithm-fault analysis using Z-bus

Module 3: **(10 Hrs)**

Economic dispatch of thermal plants. B-coefficient - optimal load flow solution –unit commitment-speed governing of turbo generator - load sharing and governor characteristics-load frequency control of single and multi area systems - implementation of Economic Dispatch and Automatic Generation Control - automatic voltage regulation - EMS. SCADA, hydro thermal scheduling.

Module 4: **(10 Hrs)**

Power system stability studies - electrical stiffness - swing equation - inertia constant - equal area criterion - multi machine stability analysis - factors affecting stability-Voltage stability problem: causes and improvement methods-introduction to power system security and reliability-deregulated power systems.

Text/ Reference Books:

1. Stevenson J V, William D, “Elements of Power System Analysis”, McGraw Hill, 1988.
2. D.P. Kothari & 1.J. Nagrath, “Modern Power System Analysis”, Tata McGraw Hill, 2007.
3. A.K. Mahalanabis, “Computer Aided Power System Analysis & Control”, Tata McGraw Hill, 1991
4. Arthur R Bergen, Vijay Vittal, “Power system Analysis”, Pearson Education (Singapore) Pte, Ltd., 2004
5. Hadi Saadat, “Power System Analysis”, Tata Mc Graw Hill, 2003.
6. J Arrilaga, C P Arnold, B J Harker, “Computer Modelling of Electric Power Systems”
7. Elgerd olleI, “Electric Energy Sytems Theory- An Introduction”, Tata Mc Graw Hill, 2ed. 1995.
8. Wadhwa C L, “Electrical Power Systems”, New Age Publication, 3ed., 2002
9. LOI LEI LAI, “Power system restructuring and deregulation”, John Wiley & sons, 2002.
10. Antonio Gomez-Exposito, Antonio j.conejo & Claudio canizares, “Electric Energy systems analysis and operation”, CRP press, 2009.

EE3007 POWER ELECTRONICS

Prerequisite: Nil

L	T	P	C
3	0	0	3

Total Hrs : 42 Hrs

Module 1: Power Semiconductor Switches (12 Hrs)

Power diodes - Basic structure and V-I characteristics - various types - **DIACs** – Basic structure and V-I characteristics – **TRIACs** - Basic structure and V-I characteristics -**Thyristors** - basic structure - static and dynamic characteristics - device specifications and ratings - methods of turning on - gate triggering circuit using UJT - methods of turning off - commutation circuits. **IGBTs -** Basic structure and V-I characteristics. **MOSFETs -** Basic structure and V-I characteristics

Module 2: Rectifiers (11 Hrs)

Line frequency phase controlled rectifiers using SCR

Single Phase – Half wave rectifier with R and RL loads – Full wave half controlled and fully controlled converters with continuous and constant currents - Input side harmonics and power factor - Effect of source inductance

Three Phase - Half wave rectifier with R and RL loads - Full wave fully controlled converters with continuous and constant currents

Module 3: Inverters & Cycloconverters (10 Hrs)

Inverters – Single phase inverters – series, parallel and bridge inverters. Single Phase Pulse Width Modulated (PWM) inverters – Basic circuit and operation.

AC regulators - single phase ac regulator with R and RL loads - sequence control of ac regulators - single phase to single phase cycloconverters - basic principle of operation.

Module 4: DC – DC Converters (9 Hrs)

Choppers - principle of operation - step-up and step-down choppers.

Switching regulators - Buck regulators - Boost regulators - Buck-boost regulators - Switched mode power supply - principle of operation and analysis

Text/Reference Books:

1. Ned Mohan, Power Electronics., John Wiley and Sons, 2nd edition, 1995.
2. Rashid, Power Electronics, Circuits Devices and Applications, Pearson Education, 3rd edition, 2004.
3. G.K.Dubey, Thyristorised Power Controllers, Wiley Eastern Ltd, 1993.
4. Dewan & Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1975.
5. Cyril W Lander, Power Electronics, Mc Graw Hill, 3rd edition, 1993.

EE3008 ENVIRONMENTAL STUDIES FOR ELECTRICAL ENGINEERS

Pre-requisites: None

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Unit 1 : Multidisciplinary nature of environmental studies (2 hrs)
Definition, scope and importance , Need for public awareness.
Unit 2 : Natural Resources : (7 hrs)
Renewable and non-renewable resources :
Natural resources and associated problems. a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources : Use and over-utilization of surface and ground water,
floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources-Equitable use of resources for sustainable lifestyles.

Unit 3 : Ecosystems (5 hrs)
Concept of an ecosystem. - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramid- Introduction, types, characteristic features, structure and function of the following ecosystem :- (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
Unit 4 : Biodiversity and its conservation (6 hrs)
Introduction – Definition : genetic, species and ecosystem diversity. - Biogeographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity. - Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
Unit 5 : Environmental Pollution (6 hrs)
Definition - Cause, effects and control measures of :- (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies. - Disasters management : floods, earthquake, cyclone and landslides.
Unit 6 : Social Issues and the Environment (6 hrs)
From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rahabilitation of people; its problems and concerns. Case Studies - Environmental ethics : Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear
accidents and holocaust. Case Studies - Wasteland reclamation -Consumerism and waste products - Environment Protection Act -Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public awareness.
Unit 7 : Human Population and the Environment (5 hrs)
Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health - Case Studies.

Unit 8 : Field work (5 hrs)

Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural - Study of common plants, insects, birds -Study of simple ecosystems-pond, river, hill slopes, etc.

Text/Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev.,
9. Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
10. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural
11. History Society, Bombay (R)
12. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
13. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
14. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
15. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
16. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
17. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
18. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
19. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
20. Survey of the Environment, The Hindu (M)
21. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
22. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines,
23. Compliances and Standards, Vol 1 and 2, Enviro Media (R)
24. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
25. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

(M) Magazine

(R) Reference

(TB) Textbook

EE 3031 DYNAMIC SYSTEM SIMULATION

Prerequisite: EE2001 Signals & Systems

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Module 1: **(11 Hrs)**

Simulation of systems using Computers: Study of popular Simulation Tools- Text based programming-Integrated Programming Environments-Case studies for typical systems Computer simulation of continuous time dynamic systems using transfer function models- electromechanical hydraulic and pneumatic systems-Simulation of discrete time and digital control systems-State Space Models-State feedback Control.

Module 2: **(11 Hrs)**

Blockset based simulation techniques- Case studies for typical systems- Computer simulation of continuous time dynamic systems using transfer function models- electromechanical hydraulic and pneumatic systems Simulation of discrete time and digital control systems.

Module 3: **(10 Hrs)**

Simulation of Power Electronic Circuits, Machines and Drives- Circuit Simulation and Systems Simulation approaches-Development of generalized machine models for induction motor. Simulation of Ward Leonard system of speed control. Simulation of induction motor driven from inverters.

Module 4: **(10 Hrs)**

Introduction to Random Processes and Stochastic Systems Theory : Time Series Methods- Simulation of AR, MA, ARMA processes- Outliers- Statistical models in simulation . discrete and continuous distributions- Poisson processes- empirical distributions- queuing models- characteristics of queuing systems- performance measures-Markovian models- steady state behaviour of infinite population Markov models-single server queues with Poisson arrivals- Steady state behavior of finite population models-Developing Random Sequences with different distributions like Gaussian, Cauchy, Laplace etc from Uniform random numbers-Discrete Even Systems

Text/Reference Books:

1. Narsingh Deo, . System Simulation with Digital Computer, Prentice Hall India, 1989
2. Graham C Goodwin, Stefan F Graebe, Mario E Salgado, *Control System Design*, Prentice Hall India, 2003
3. Richard C. Dorf and Robert H Bishop, *Modern Control Systems*, 8th Ed., Addison Wesley, 1998.
4. Karl J. Aström, Björn Wittenmark, *Computer Controlled Systems: Theory and Design*, 3rd Ed. Prentice Hall, 1997.
5. Douglas M. Considine, *Process/Industrial Instruments & Control Handbook*, 4th Ed., McGrawHill, 1993.
6. Jai P. Agarwal, *Power Electronic Systems: Theory & Design*, Pearson Education Asia, 2001.
7. P.C. Sen, *Principles of Electrical Machines & Power Electronics*, John Wiley, 2003.
8. Louis G Birta and Gilber Arbez, Modelling and Simulation(Exploring Dynamic System behavior) Springer Verlag, 2007

EE3032 DIGITAL CONTROL SYSTEMS

Pre-requisite: EE3002 Control Systems I

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Module 1: (**11 Hrs**)

Basic digital control system- Examples - mathematical model-ZOH and FOH- choice of sampling rate-principles of discretisation-Mapping between s-domain and z-domain-Pulse transfer function- Different configurations for the design- Modified z-transform- Multi-rate discrete data systems.

Module 2: **(11 Hrs)**

Time responses of discrete data systems- Correlation between time response and root locations in the z-plane-Steady state performance- Disturbance Rejection- Robustness and Sensitivity -Jury's stability test – Routh stability criterion on the r-plane -Root locus- Polar plots-Nyquist stability criterion- Bode plot- Bilinear transformation method .

Module 3: **(10 Hrs)**

Cascade compensators using Root Locus- Design of PID controllers by using bilinear transformation- Digital controller design using bilinear transformation- Dead-beat response design- Deadbeat controller without and with prescribed manipulated variable-Choice of sample time for deadbeat controller-Realization of digital controllers- Computer based simulation.

Module 4: **(10 Hrs)**

State variable model of discrete data systems with S/H devices- State transition equations- state diagrams-Transfer function- Transformation to Jordan canonical form and phase variable form- Computation of state transition matrix using Cayley-Hamilton theorem and z-transform method- Response between sampling instants-Controllability, Observability, stabilizability and reachability- Loss of controllability and observability due to sampling- Pole placement design using state feedback for SISO systems- Computer based simulation.

Text/Reference Books:

1. M.Gopal,Digital control and State Variable methods, Tata McGraw –Hill , 1997
2. B.C.Kuo, Digital Control Systems, 2nd Ed., Oxford University Press,1992.
3. Constantine H. Houpis and Gary B. Lamont, Digital control systems Theory, hardware software, Mc-Graw Hill Book Company, 1985.
4. R.Isermann, Digital control systems, Volume 1, Fundamentals , Deterministic control,(2nd revised edition),Springer Verlag, 1989.
5. R.G.Jacquot, Modern digital control systems, (second edition),Marcel Dekker, Inc., 1995.
6. Philips and Nagle, Digital control system analysis and design, Prentice Hall, 1984.
7. G.F.Franklin, J.David Powell and M.Workman,Digital Control of Dynamic Systems, 3rd Ed.,,Addison Wesley, 2000.

EE 3033 FUZZY LOGIC SYSTEMS

Pre-requisite: None

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Module 1: **(12 Hrs)**

Theory of Fuzzy Sets and fuzzy relations: Fuzzy Reasoning-Fuzzy Rules-Fuzziness compared to randomness-Introduction - Classical sets and fuzzy sets-operations on both- properties of fuzzy sets-classical relations and fuzzy relations- cardinality of fuzzy relations-Fuzzy Cartesian product and composition–fuzzy tolerance and equivalence relations- value assignments - cosine amplitude-max-min method.

Module 2: **(12 Hrs)**

Fuzzification and De-fuzzification : Formation of Fuzzy Rule Base-Membership functions - features -standard forms –fuzzification - membership value assignments - intuition – inference-rank ordering - angular fuzzy sets - inductive reasoning -fuzzy to crisp conversion – lambda/alpha cuts for fuzzy sets and fuzzy relations - defuzzification methods.

Module 3: **(11 Hrs)**

Fuzzy Logic : Classical logic and fuzzy logic –fuzzy rule based systems - approximate reasoning - canonical rule forms - decomposition of compound rules - likelihood and truth classification - aggregation of fuzzy rules – fuzzy inference systems- Mamdani and Takagi-Sugeno fuzzy models- fuzzy control models-P-1-D like fuzzy control rules – implementation. Computer based simulation-Language based programming in C/C++-Use of Simulation Tools.

Module 4: **(7 Hrs)**

Fuzzy nonlinear simulation- fuzzy classification - clustering – fuzzy pattern recognition - fuzzy control systems- fuzzy optimization - case studies – Fuzzy Logic combined with Neural Networks and Genetic Algorithms-Soft Computing Techniques- Fuzzy measures (brief introduction only).

Text/Reference Books:

1. Timothy J Ross, *Fuzzy Logic with Engineering Applications*, McGraw Hill, 2007.
2. Guanrong Chen & Trung Tat Pham Introduction to Fuzzy Systems, Chapman & hall /CRC, 2006
3. Driankov D., Hellendoorn H., Reinfrank M, *An Introduction to Fuzzy Control*., Narosa Publications ,1993.
4. Robert Babuska, *Fuzzy Modeling for Control*, International Series in Intelligent Technologies, Kluwer Academic Publications, 1998
5. Ronald R Yager and Dimitar P Filev, *Essentials of Fuzzy Modelling & Control*., John Wiley & Sons, Inc, 2002.
6. J.-S.R.Jang, C.-T.Sun,E.Mizutani, *Neuro-Fuzzy and Soft Computing*, Prentice Hall, 1997.
7. B.Kosko, *Fuzzy Engineering*, Prentice Hall, 1997

EE3034 ELECTRICAL MACHINE DESIGN

Prerequisite: EE2007 Electrical Machines I & EE3003 Electrical Machines II

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Module 1: DC machines **(11 Hrs)**

Output equation - main dimensions - choice of specific electric and magnetic loadings - choice of speed and number of poles - design of armature conductors, slots and winding - design of air-gap, field system, commutator, interpoles, compensating winding and brushes - Carter's coefficient - real and apparent flux density - design examples.

Module 2: Transformers **(10 Hrs)**

Output equation of single phase and three phase power transformers - main dimensions - choice of specific electric and magnetic loadings - design of core, LV winding, HV winding, tank and cooling tubes - prediction of no load current, forces on winding during short circuit, leakage reactance and equivalent circuit based on design data - design examples.

Module 3: Alternators **(10 Hrs)**

Output equation of salient pole and turbo alternators - main dimensions - choice of specific electric and magnetic loadings - choice of speed and number of poles - design of armature conductors, slots and winding - design of air-gap, field system and damper winding - prediction of open circuit characteristics and regulation of the alternator based on design data - design examples.

Module 4: Induction machines **(11 Hrs)**

Output equation - main dimensions - choice of specific electric and magnetic loadings - design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors - calculation of rotor bar and end ring currents in cage rotor - calculation of equivalent circuit parameters and prediction of magnetising current based on design data - design examples

Text/Reference Books:

1. Clayton & Hancock, Performance & Design Of DC Machines, CBS, 3rd edition, 2001
2. Sawhney, Electrical Machine Design, Educational Publishers and Distributors, 1998.
3. Say M. G, Performance & Design of AC Machines, Pitman, ELBS.3rd edition, 1983.

EE 3035 BIOMEDICAL INSTRUMENTATION

Pre-requisites : None

L	T	P	C
3	0	0	3

Total Hrs : 42 Hrs

Module 1: **(11 Hrs)**

Introduction to electrophysiology – action potential – transducers for biomedical applications -electrodes – mono polar and bipolar recording - heart and cardiovascular system –blood pressure measurement – characteristics of blood flow-electromagnetic and ultrasonic blood flow meters- indicator dilution technique - plethysmography - sounds of the heart – blood pumps – heart lung machine - ECG – Eindhoven 's law - 12 lead system – cardiac pace maker –defibrillator -EMG – introduction to nervous system and brain -EEG –

Module 2: **(11 Hrs)**

Introduction to intensive care monitoring –patient monitoring instruments –organization of hospital for patient care monitoring – respiratory physiology – measurements in respiratory system –respiratory therapy equipments – instrumentation for sensory measurement and behavioral studies – ultrasonics in medicine

Module 3: **(10 Hrs)**

Lasers in medicine - X ray and radio isotopes – radio therapy equipment -safety and dosage

Module 4: **(10 Hrs)**

Renal physiology – membranes for haemodialysis – haemodialysis machines- lithotripters –

Measurement of p^{H}, $p^{CO}{}_{2}$ and $p^{O}{}_{2}$

Text/Reference Books:

1. Hand book of Biomedical instrumentation By RS Khandpur, Tata McGrawHill , 2007
2. Biomedical instrumentation and measurements By Leslie Cromwell, Fred J Weibell
   Erich A Pfeiffer , Pearson 2008
3. Principles of Applied biomedical instrumentation , Geddes & Baker , 3rd edition John Wiley & Sons

EE3036 ILLUMINATION ENGINEERING

Pre-requisites : None

L	T	P	C
3	0	0	3

Total Hrs : 42 Hrs

Module 1: **(9 Hrs)**

Introduction : State the need for Illumination, Define good Illumination, Radiation - Eye and Vision - The purkinje effect- Laws of Illumination –Candela- Frechner's law - Inverse Square Law - Lambert's Cosine Law of Incidence Photometry and spectrophotometry .

Module 2: **(10 Hrs)**

Electric light sources and their operating characteristics: Incandescent lamps: ratings, operating characteristics- vapor lamps- mercury vapor lamps- sodium vapor lamps-Fluorescent lamps: fundamentals, ratings, cathode types- starters- ballasts- operating characteristics- CFL- Bulb Temperature Vs Light output - Lumen Maintenance Curve

Module 3: **(11 Hrs)**

Entities in the illumination systems and their units: Illumination, intensity, brightness, soild angle relationships, luminous flux-luminosity-measurement of illumination- determination of total luminous flux emitted by a plane source, circular disc source, rectangular source, strip source.

Module 4: **(12 Hrs)**

Design of lighting systems- Interior Lighting -Sports Lighting -Road Lighting -Street lighting-Factory outdoor lighting- Flood lighting -Maintenance of lighting system and Lighting Calculations considering day light. Design of Energy efficient lighting systems.

Text/Reference Books:

1. Prathab H, “Art and Science of Utilization of Electrical Energy”, Dhanapat Rai & Sons, Delhi
2. Steffy G, “Architectural Lighting Design”, 3rd Edition, John Wiley & Sons, 2008
3. Boast W.B, Illumination Engineering, Mc Graw Hill Book Company, 1953.
4. Cotton H, Principles of Illumination, John Wiley and Sons, 1960.

EE3037 ANALOG FILTERS

Pre-requisites: EE2001 Signals & Systems, EE2004 Basic Electronic Circuits,

EE2005 Circuits & Networks, EE2008 Analog Electronic Circuits & Systems

L	T	P	C
3	0	0	3

Total Hrs : 42 Hrs

Module 1: **(12 Hrs)**

Review of continuous time LTI systems – frequency domain representation of continuous time signals. Laplace transform- inverse Laplace transform- properties.

Categories of Filters- LP, HP, BP, BE and All Pass Filters- Second Order s-domain equations in each case and their pole-zero plots.

The Filter approximation problem: - Butterworth Approximation- Chebyshev and Inverse Chebyshev Approximations- Elliptic Approximation- Bessel approximation- Phase and Group delay characteristics of approximation functions-delay equalizer functions

Module 2: **(10 Hrs)**

Passive filters Realization of first order First Order LP, HP, BP, All Pass Filters- frequency transformation.

Higher order filters- network functions-synthesis of higher order passive filters. Singly and doubly terminated LC ladders. Limitations of Passive filters

Module 3: **(11 Hrs)**

Active Filters Single OPAMP Biquads : First Order LP,HP,BP, All Pass Filters- Biquad Topologies, Analysis and Design of Single OPAMP Biquads with finite gain . Analysis and design of LP, HP and BP Filter with second order response. Sensitivity Analysis of Single OPAMP Filters. Analysis and design of various multiple OPAMP filters - Compensation

Module 4: **(9 Hrs)**

Inductor Simulation, Antoniou Gyrators, LP,HP,BP and BE Filters using Antoniou Gyrators**.**

Structure for LP, HP, BP and BE SC Filters, Basic ideas of method of realization of higher order filters. Synthesis of LC ladder Networks using gyrators

Text /Reference books:

1. G. Daryanani, Digital and Analog Communication Systems, John Wiley and Sons, 1976
2. M.E Van Valkenberg, Analog Filter Design, Prentice Hall of India, 2004.
3. M.E Van Valkenberg , Design of Analog Filters, Oxford University Press,2001
4. L.P Huelsman, Introduction to the Theory and Design of Active Filters, McGraw Hill, 1980
5. Roubik Gregorian and Gabor C, Analog MOS Integrated Circuits for Signal Processing, John Wiley and Sons, 1986
6. Kendall L. Su, Analog Filters, Kluwer academic publishers, 1996
7. Wai-Kai Chen, Passive and active filters, John Wiley & Sons, 1986

EE3038: POWER SEMICONDUCTOR DEVICES

Pre-requisite: None

L	T	P	C
3	0	0	3

Total Hrs: 42 Hrs

Module 1: **(11 Hrs)**

Power Diode: Basic Structure and 1-V Characteristics . Breakdown Voltages and Control . On State Losses . Switching Characteristics . Turn on Transient . Turn off Transient . Reverse Recovery Transient . Schottky Diodes . Snubber Requirements for Diodes and Diode Snubbers.

Thyristor: Basic Structure . V-1 Characteristics . Turn on Process . On State operation . Turn off process . Switching Characteristics .Turn on Transient and di/dt limitations . Turn off Transient . Turn off time and reapplied dv/dt limitations . Ratings of Thyristors . Snubber Requirements and Snubber Design.

Module 2: **(9 Hrs)**

DIAC: Basic Structure and operation . V-1 Characteristics . Ratings

TRIAC: Basic Structure and operation . V-1 Characteristics . Ratings . Snubber Requirements.

Gate Turnoff Thyristor (GTO): Basic Structure and Operation . GTO Switching Characteristics . GTO Turn on Transient . GTO Turn off Transient . Minimum ON and OFF State times .Maximum Controllable Anode Current . Overcurrent protection of GTOs

Module 3: **(12 Hrs)**

Power BJT: Basic Structure and 1-V Characteristics . Breakdown Voltages and Control . Second Breakdown and its Control- FBSOA and RBSOA Curves - On State Losses . Switching Characteristics . Resistive Switching Specifications . Clamped Inductive Switching Specifications . Turn on Transient . Turn off Transient . Storage Time .Base Drive Requirements . Switching Losses . Device Protection- Snubber Requirements for BJTs and Snubber Design - Switching Aids.

Power MOSFET: Basic Structure . V-1 Characteristics . Turn on Process . On State operation . Turn off process . Switching Characteristics . Resistive Switching Specifications . Clamped Inductive Switching Specifications - Turn on Transient and di/dt limitations . Turn off Transient . Turn off time . Switching Losses . Effect of Reverse Recovery Transients on Switching Stresses and Losses - dv/dt limitations . Gating Requirements . Gate Charge - Ratings of MOSFETs. FBSOA and RBSOA Curves . Device Protection -Snubber Requirements .

Module 4: **(10 Hrs)**

Insulated Gate Bipolar Transistor (IGBT): Basic Structure and Operation .Latch up IGBT Switching Characteristics . Resistive Switching Specifications . Clamped Inductive Switching Specifications - IGBT Turn on Transient . IGBT Turn off Transient- Current Tailing - Ratings of MOSFETs. FBSOA and RBSOA Curves . Switching Losses - Minimum ON and OFF State times - Switching Frequency Capability - Overcurrent protection of IGBTs . Short Circuit Protection . Snubber Requirements and Snubber Design. New power semiconductor devices.

Text/Reference Books:

1. Ned Mohan et.al ,"Power Electronics",John Wiley and Sons,2006
2. G. Massobrio, P. Antognet," Semiconductor Device Modeling with Spice", McGraw-Hill, Inc.,1988.
3. B. J. Baliga," Power Semiconductor Devices",Thomson, 2004.
4. V. Benda, J. Gowar, D. A. Grant," Power Semiconductor Devices. Theory and Applications", John Wiley & Sons1994.99

EE3039 ADVANCED PROCESSOR ARCHITECTURE & SYSTEM ORGANISATION

Pre-requisites: EE3001 Microprocessors & Microcontrollers

L	T	P	C
3	0	0	3

Total Hrs : 42 Hrs

Module 1: **(11 Hrs)**

Basic Concepts of Microprocessors, Different Architectures of Microprocessors. 8051 Microcontroller-Hardware, 1/O Pins, Ports and Circuits, External Memory, Counters and Timers, Serial Data Input/ Output, Interrupts, Assembly Language Programming of 8051.

Module 2: **(11 Hrs)**

8086 Hardware Details, Memory Organization and Addressing Modes, System Bus Structure – Minimum Mode and Maximum Mode, Interrupt Priority Management, System Bus Timing, Multiprocessor Configuration

Module 3: **(10 Hrs)**

Design of 8086 based system, Architecture of 80286, 80386, Development of Personal Computers.

Module 4: **(10 Hrs)**

Processor Types and Instruction Sets , Microcode , Protection and Processor Modes, Physical Memory , Virtual Memory, Caches, Bus Architecture , Parallelism and Pipelining , Performance Assessing of processors,

Text/Reference Books:

1. Brey B.B., The Intel Microprocessors - Architecture, Programming & Interfacing, Prentice Hall, 6th edition, 2004.
2. Liu Y.C. & Gibsen G.A., Microcomputer System: The 8086/8088 Family, Architecture Programming and Design , Prentice Hall of India, 2nd edition,2004 .
3. Ayala K.J., The 8051 Micro controller, Architecture, Programming and Applications, Penram International Publishing (India),2nd edition,1996.
4. Ayala K.J., The 8086 Microprocessor: Programming and Interfacing The PC, Penram International Publishing (India),1995.
5. Trebel, Walter A Singh, Avtar, 8088 and 8086 microprocessors, Programming Interfacing, Software, Hardware and Aplications , Pearson Education , 4th edition, 2004.
6. Douglas E Comer, Essentials of Computer Architecture , Pearson Education,2005.
7. Pattersen D.A. & Hennesy J.L., Computer Organization and Design: The Hardware/ Software Interface, Harcourt Asia Pvt Ltd (Morgan Kaufman), 2nd edition, 2002.
8. Heuring V.P. & Jordan H.F., Computer System Design and Architecture, Addison Wesle Hamacher, Vranesic & Zaky, Computer Organisation, McGraw Hill,2002

EE3040 LT & HT DISTRIBUTION SYSTEMS

Pre-requisites : None

Total Hrs : 42 Hrs

L	P	T	C
3	0	0	3

Module 1: **(11 Hrs)**

Power system-general concepts-distribution of power, load and energy forecasting-factors in power system loading , Power system analysis-load flow-fault studies-voltage control, Optimization of distribution system-network cost modeling-economic loading of distribution transformers. Distribution system reliability-reliability assessment techniques

Module 2: **(10 Hrs)**

Consumer services-maximum demand, diversity and load factor-consumer load control for power shortages, Tariffs-costing and pricing –economically efficient tariff structure.

Overhead and underground lines-optimum design considerations, Power capacitors-size of capacitor for power factor improvement- HT and LT capacitor installation requirements.

Module 3: **(10 Hrs)**

Distribution System Design- Electrical Design Aspects of Industrial, Commercials Buildings-

Design, estimation and costing of outdoor and indoor Substations, Electrical Safety and Earthing Practices at various voltage levels- Lightning protection.-Regulations and standards.

Module 4: **(11 Hrs)**

Distribution Automation System : Necessity, System Control Hierarchy- Basic Architecture and implementation Strategies for SCADA and DAC systems -Basic Distribution Management System Functions.

Communication Systems for Control and Automation- Wireless and wired Communications- SCADA and DAC communication Protocols, Architectures and user interface

Text/References:

1. Turan Gonen, “Electric Power Distribution system Engineering” Mc Graw-hill ,Inc,1987
2. A.S. Pabla, “ Electric Power Distribution systems” Tata Mc Graw-hill Publishing company limited, 4th edition, 1997.
3. Alexander Eigeles Emanuel, “Power Definitions and the Physical Mechanism of Power Flow”, John Wiley & Sons, October 2009.
4. “Handbook of International Electrical Safety Practices”, John Wiley & Sons, PERI June 2009.
5. Ali A. Chowdhury, Don O. Koval, “Power distribution system reliability-Practical methods and applications” John Wiley & sons Inc., *IEEE Press* 2009
6. Richard E.Brown, “Electric power distribution reliability” Taylor & Francis Group,LLC,2009.
7. James Northcote-Green, Robert Wilson, “Control and automation of electrical power distribution system”, Taylor & Francis Group, LLC,2007.
8. S.Sivanagaraju, V.Sankar, Dhanpat Rai & Co, “Electrical Power Distribution and Automation”,2006.
9. Pansini,Anthony J, “Guide to electrical power distribution system”,Fairmont press, inc., 6th edition,2006.
10. Stuart A. Boyer, “SCADA-Supervisory Control and Data Acquisition” Instrument Society of America Publication,2004
11. Leveque, Francois , “Transport Pricing of Electricity Networks” Springer 2003
12. Lakervi & E J Holmes, “Electricity distribution network design”, Peter Peregrimus Ltd. 2nd Edition,2003
13. William H. Kersting, “Distribution system modeling and analysis” CRC press LLC, 2002.
14. Michael Wiebe, “A Guide to Utility Automation: Amr, Scada, and It Systems for Electric Power” PennWell,1999.
15. IEEE Press: IEEE Recommended practice for Electric Power Distribution for Industrial Plants, published by IEEE, Inc., 1993

EE3041 DC DRIVES

Prerequisite: EE3007 Power Electronics

Total Hrs : 42 Hrs

L	T	P	C
3	0	0	3

Module 1: Introduction **(8 Hrs)**

Introduction to Drives– characteristic matching of the load and the motor - Criteria for selection of subsystems of the Drive - Thermal consideration – considerations in the match between the Power Electronics converter and the motor - Characteristics of mechanical systems - stability criteria

Module 2: Modelling of DC Machine **(8 Hrs)**

Theory of operation – Induced EMF – Equivalent circuit and electromagnetic torque – Elecrtomechanical modeling – state space modeling – Block diagram.

Module 3: Phase controlled DC motor Drives **(14 Hrs)**

Field Control – Armature Control – Four quadrant operation – Single phase controlled convertors - Three phase controlled convertors – half controlled convertor – Converters with freewheeling – Converter configuration for a four quadrant DC motor drive – Steady state analysis of Three phase converter controlled DC motor drive – Two quadrant, Three phase converter controlled DC motor drive. Two quadrant, DC motor drive with field weakening. Harmonics and Associated problems – Effect of field weakening.

Module 4: Chopper Controlled DC motor Drive **(12 Hrs)**

Principle of operation of chopper – Four quadrant chopper circuit and its operation in all quadrants - Model of chopper – Steady state analysis of chopper controlled DC motor drive- Torque pulsations.

Text/Reference Books:

1. Electrical Motor Drives : Modeling, Analysis and control : R Krishnan - 1st edition – 2007 : Pearson Eduction.
2. Electric Drives Concepts and applications – Vedam Subrahmanyam – 1st Edition 1994 : Tata McGrawHill Education Pve Ltd.
3. André Veltman, Duco W.J. Pulle and Rik W. De Doncker : Fundamentals of Electrical Drives – 1st edition 2007 Springer
4. G.K.Dubey & C.R.Kasaravada ,"Power Electronics & Drives", Tata McGraw Hill,1993.
5. Dubey ,Power Electronics Drives ,Wiley Eastern,1993
6. Chilikin ,M ,Electric drives , Mir publications, 2nd edition,1976
7. Ned Mohan ,"Power Electronics", et. al ,Wiley 2006

EE3042 ELECTRICAL SYSTEM DESIGN FOR BUILDINGS

Pre-requisites : None

Total Hrs: 42 Hrs

L	T	P	C
3	0	0	3

Module 1: **(10 Hrs)**

Electrical Installations: general requirements, design considerations, testing, estimating and costing - symbols, standards – National Electrical Code – design of panel boards – design and estimation of service connections – design and safety aspects of residential buildings

Module 2: **(10 Hrs)**

Illumination schemes – types of light sources and lighting arrangements – energy efficiency in lamps and illumination – design of lighting for various purposes.

Module 3: **(12 Hrs)**

Electrical system design, estimation and costing of commercial buildings, hospitals, recreational and assembly buildings, cinema theatres, small industries, Design of electrical installations of high rise buildings: electrical aspects of lifts, escalators services, stand by generators.

Module 4: **(10 Hrs)**

Design, estimation and costing of outdoor and indoor Substations –Design of earthing system, earth mat, plate and pipe earthing – Safety of electrical installations – Lightning protection.

Text/Reference Books:

1. K.B. Raina, S.K. Bhatacharya, “Electrical Design, Estimating and Costing,” New Age International (p) Ltd. Publishers, New Delhi, 2002.
2. Surjit Singh. “Electrical Estimating and Costing”, Dhanpat Rai & Co., Delhi, 2005.
3. ISI, National Electrical Code, Bureau of Indian Standard Publications.
4. G. Ramamurthy, “Hand book of Electrical Power Distribution”, Universities Press (India) Private Ltd., New Delhi, 2004.
5. N Alagappan,S Ekambaram, “Electrical estimating and Costing”, Mc Graw Hill,1999

EE3092 ELECTRICAL MACHINES LAB II

Prerequisite: EE3003 Electrical Machines II

L	T	P	C
0	0	3	2

Total Hrs : 42 Hrs

List of Experiments

1. No load and blocked rotor tests on a 3-phase squirrel cage induction motor, determination of its equivalent circuit and performance analysis by drawing the circle diagram.
2. No load and blocked rotor tests on a 3-phase slip ring induction motor, determination of its equivalent circuit and performance analysis by drawing the circle diagram.
3. No load and blocked rotor tests on a single phase induction motor, determination of its equivalent circuit and performance analysis.
4. Load tests on a 3-phase squirrel cage induction motor and its performance analysis.
5. Load tests on a 3-phase slip ring induction motor and its performance analysis.
6. Operation of a dc machine coupled induction machine as an induction generator and its performance analysis.
7. Speed control of an Induction motor by pole changing method.
8. Speed control of an Induction motor by variable frequency method.
9. Predetermination of voltage regulation of a 3-phase alternator by EMF/ MMF methods.
10. Predetermination of voltage regulation of a 3-phase alternator by ZPF method.
11. Slip test on a salient pole alternator and predetermination of voltage regulation.
12. Synchronization of a 3-phase alternator to the supply mains and plotting of V-curves/ inverted V-curves.

Text/Reference Books:

1. Say M. G, Performance & Design of AC Machines, Pitman, ELBS.3rd edition, 1983.
2. Langsdorf A.S., Theory of AC Machinery, McGraw Hill., 2nd edition, 2002.