GOVT. COLLEGE OF ENGINEERING, AMRAVATI

CURRICULUM

B. TECH. (ELECTRICAL)
VII and VIII Semester

Department of Electrical Engineering

SEM III													
Course Code	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
						Theory				**Practical**		**Total**	
		Theory Hrs /week	**Tutorial Hrs /week**	**Practical Hrs /week**	**Total**	**TA**	**CT1**	**CT2**	**ESE**	**ICA**	**ESE**		
SHU303	Engineering Mathematics - III	3	--	---	3	10	15	15	60	---	---	100	3
ETU311	Electronic Devices and Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU301	Signals & Systems	3	1	---	4	10	15	15	60	---	---	100	4
EEU302	Network Analysis	3	1	---	4	10	15	15	60	---	---	100	4
EEU303	Electrical Measurement and Instrumentation	3	---	---	3	10	15	15	60	---	---	100	3
ETU312	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU304	Signals & Systems Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU305	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU306	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
SHU305	General Proficiency - II	1	---	2	3	---	---	---	---	25	25	50	2
Total		**16**	**2**	**10**	**28**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**
SEM IV													
SHU401	Engineering Mathematics - IV	3	--	---	3	10	15	15	60	---	---	100	3
EEU401	Pulse & Digital Circuits	3	1	---	4	10	15	15	60	---	---	100	4
EEU402	Electrical Machines - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU403	Energy Resources & Generation	3	---	---	3	10	15	15	60	---	---	100	3
EEU404	Electromagnetic Engineering	3	1	---	4	10	15	15	60	---	---	100	4
SHU402	Engineering Mathematics Lab	1	---	2	3	---	---	---	---	25	25	50	2
EEU405	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU406	Electrical Machines - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU407	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU408	Computational Lab - I	---	---	2	2	---	---	---	---	25	25	50	1
Total		**16**	**2**	**10**	**28**	**50**	**75**	**75**	**300**	**125**	**125**	**750**	**23**

NOTE:

1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment

2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.

SEM V													
EEU501	Electrical Machines -II	3	---	---	3	10	15	15	60	---	---	100	3
EEU502	Power System Analysis- I	3	---	---	3	10	15	15	60	---	---	100	3
EEU503	Control System - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU504	Introduction to Microprocessor and Microcontrollers	3	---	---	3	10	15	15	60	---	---	100	3
EEU505	Industrial Organization & Management	3	---	---	3	10	15	15	60	---	---	100	3
EEU506	Electrical Machines - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU507	Power System Analysis - I Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU508	Control System - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU509	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU510	Computational Lab-II	1	---	2	3	---	---	---	---	25	25	50	2
EEU511	Self Study - I	---	---	----	0	---	---	---	---	25	---	25	2
Total		**16**	**0**	**10**	**26**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

NOTE :

1) Self study - I is based on one class test each on the basis of 20% curriculum of the courses EEU501,EEU502,EEU503,EEU504 declared by respective course coordinator at the beginning of the semester.

2) One faculty member shall be appointed as course coordinator for self study - I and his/her teaching work-load shall be consider 1 hr/week

SEM VI													
EEU601	Power Electronics	3	--	---	3	10	15	15	60	---	---	100	3
EEU602	Power System Analysis - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU603	Control System - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU604	Electrical Machine Design	3	---	---	3	10	15	15	60	---	---	100	3
EEU605	Operation Research Techniques	3	---	---	3	10	15	15	60	---	---	100	3
EEU606	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU608	Control System - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU609	Electrical Machine Design Lab	---	---	2	2					25	25	50	1
EEU610	Minor Project	----	----	2	2	---	----	---	----	25	25	50	2
EEU611	Self Study - II	---	---	----	0	---	---	---	---	25	---	25	2
EEU612	Industrial Lecture - I*	1	---	----	1	---	---	---	---	---	---	0	---
Total		**16**	**0**	**10**	**26**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

NOTE:

1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment

2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.

3) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II

4) Self study-II is based on one class test each on the basis of 20% curriculum of the courses EEU601,EEU602,EEU603,EEU604 declared by respective course coordinator at the beginning of the semester.

5) One faculty member shall be appointed as course coordinator for self study-II and his/her teaching work-load shall be consider 1 hr/week

6)Assessment of Industrial Lecture - I is scheduled in VII sem with Industrial Lecture-II

SEM VII													
EEU701	Switch Gear and Protection	3	---	---	3	10	15	15	60	---	---	100	3
EEU702	Linear & Digital Integrated Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
EEU705	Switch Gear and Protection Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU706	Linear & Digital Integrated Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU707	Elective –I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2
EEU709	Seminar	---	---	2	2	---	---	---	---	50	---	50	2
EEU710	Industrial Training /Visit	---	---	---	0	---	---	---	---	50	---	50	1
EEU711	Industrial Lecture - II*	1	---	---	1	---	---	---	---	25	---	25	1
EEU712	Self Study - III	---	---	---	0	---	---	---	---	25	---	25	2
Total		**13**	**0**	**12**	**25**	**40**	**60**	**60**	**240**	**250**	**100**	**750**	**23**

NOTE:

1) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II

2) Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester.

3) One faculty member shall be appointed as course coordinator for self study - III and his/her teaching work-load shall be consider 1 hr/week

4) Students of this department shall select any on Interdisciplinary Elective offered by other departments. Interdisciplinary Elective shown below will be offered to students of the other department.

SEM VIII													
EEU801	Power Systems Stability	3	---	---	3	10	15	15	60	---	---	100	3
EEU802	Electrical Drives and Control	3	---	---	3	10	15	15	60	---	---	100	3
EEU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
EEU805	Power Systems Stability Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU806	Electrical Drives and Control Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU807	Elective – II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU808	Project Phase - II	---	---	6	6	---	---	---	---	75	100	175	6
EEU809	Self study - IV	---	---	---	0	---	---	---	---	25	----	25	2
Total		**12**	**0**	**12**	**24**	**40**	**60**	**60**	**240**	**175**	**175**	**750**	**23**

NOTE:

1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment

2) Duration of ESE is 2 Hrs 30 Minutes for all courses

3) Self study - IV is based on one class test each on the basis of 20% curriculum of the courses ,EEU801,EEU802,EEU803,EEU804 declared by respective course coordinator at the beginning of the semester.

4) One faculty member shall be appointed as course coordinator for self study - IV and his/her teaching work-load shall be consider 1 hr/week

LIST OF ELECTIVES

Interdisciplinary Elective (EEU704)	**Elective - I (EEU703)**	**Elective II (EEU803)**	**Elective III (EEU804)**
A) Electromechanical Energy Conversion	A) Digital Signal Processing	A) Multirate DSP and Wavelet	A) HVDC and FACTS
B) Robotics and Automation	B) Advanced Microprocessor	B) High Voltage Engineering	B) High Voltage Transmission
C) Energy Efficiency in Electrical Utilities	C) Computer Methods in Power System Analysis	C) Network Synthesis	C) Power Quality & Deregulation
	D) Power System Operation and Control	D) Artificial Neural Network	D) Statistical Signal Processing

EEU 701 SWITCHGEAR AND PROTECTION

Teaching Scheme: 03 L + 00 T Total: 03 Credit: 03
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2 Hrs.30 min.

Circuit Interruption: Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.
Fuses: Types, Constructional features, operation, Characteristics and Applications
Circuit Breaker: Air break, Air blast, minimum oil-type, SF6, Vacuum, Miniature, Earth leakage and Moulded Case – types constructional features, operation and application.
Relaying Principle: Components, Essential features, Characteristics, Terminology, CT's and PT's, Relay classification.
Electromechanical Relays: Over current, Directional, Distance and Differential – types, constructional features, operation, characteristics and application.
Protection of Transmission Lines
Relaying schemes: over current, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.
Protection of Transformers, Motors, Generators and Buses.
Modern trends in power system protection
Basic concepts, equipments, comparators, Characteristics realization – over current, directional, differential and distance relay. Introduction to numerical relay. Block Diagram of Numeric relay.

Text Book:

1. Power System Protection and Switchgear, Badri Ram and B. N. Vishwkarma, 3rd Edition Tata Mc-Graw Hill Publishing Company Limited, New Delhi. 2003.
2. Power System Protection and Switchgear, B. Ravindranath and M Chander, Wiley Eastern Ltd, New Delhi, 2006.
3. Fundamental of power system protection, Y.G. Paithankar and S. R. Bhide ,PHI publications, 2008

Reference Books:

1. Switchgear Handbook, R. T. Lythall, J and P Newness Butterworth, London. 1993.
2. Power system protectio0n and switchgear, Bhuvanesh A Oza and Nair, Tata McGraw Hill Education private limited New Delhi.
3. Protective Relaying, A. R. Van and C Warringtan , Chapman Hall, London.,2 Edition, Vol 1 and 2, 2000
4. Generation Protection and Switchgear, V. A. Slabikov, CIT Press, Coimbatore. 1998.
5. http://www.nptel.iitm.ac.in/
6. www.ocw.mit.edu

EEU 702 LINEAR AND DIGITAL INTEGRATED CIRCUITS

Teaching Scheme: 03 L + 00 T Total: 03 Credit: 03
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2 Hrs.30 min.

Linear Integrated circuit

Review of op-amp ; Applications of op amp as V to I converter, dc and ac voltmeter, match diode finder, LED tester, zener diode tester using V to I converter, using I to V converter, light intensity meter using I to V converter. Instrumentation amplifier, Application of instrumentation amplifier as temp controller, temperature indicator, Light intensity meter, flow measurement thermal conductivity measurement, weigh scale; phase detector voltage comparator, window detector, time marker generator, Schmitt trigger; voltage limiter; practical differentiator; practical integrator; logarithmic amplifier; analog amplifier; use of op-amp in medical electronics; electronic thermometer; simulation of inductance using op-amp; sine square and triangular waveform generator.

Timer-IC 555, monostable and astable multivibrator using IC 555; series and shunt regulated power supply, IC 723, IC 7805 etc; phase locked loop (PLL), applications of PLL, IC 565.

Digital Circuits

Combinational logic design using MSI circuit.

Introduction, Multiplexers and their use in combinational logic design, Demultiplexers / decoders and their use in combinational logic design, adders and their use as subtractors, BCD arithmetic, Arithmetic logic Unit (ALU), Digital comparators, Parity generators, code converters, priority encoder, decoder drivers for display devices.

Programmable Logic devices

Introduction, ROM as PLD, Programmable Logic Array, Programmable Array Logic, Complex Programmable Logic Devices (CPLDs), Field- Programmable Gate Array (FPGA)

Computer aided design of digital systems

Introduction, CAD concept, CAD tools, Introduction to VHDL, describing combinational circuits using VHDL, describing sequential circuits using VHDL

Text Books

1. Op-amps and Linear Integrated Circuits Technology, R.A.Gaikwad, PHI publication, 1999
2. Modern Digital Electronics, R.P. Jain, 3rd edition, Tata Mc-Graw Hill, 2005

References

1. Linear Integrated Circuits, D.Roy Chaudhari ,New Age International Publisher, 2005
2. Design of Operational Amplifier and Analog Integrated Circuits, S.Franco TMH Publication, 2002
3. Digital Electronics-Circuits and Systems, V. K. Puri, 1st edition, Tata McGraw Hill Publications, 2003
4. Digital Principles and Application, A. P. Malvino, D. P. Leach, 6th edition, Tata Mc-Graw Hill,2006.

EEU703 ELECTIVE-I
(A) DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03 L + 00 T Total: 03 **Credit: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE: 2 Hrs.30 min.

Signals and Signal Processing : Characterization and classification of signals, Typical signal processing operations , Typical signal processing applications, Advantages of digital signal processing

Time Domain Representations of Signals and Systems: Discrete time signals, Operations on sequences, Discrete time systems, linear time invariant discrete time systems, Characterization of LTI systems.

Transform Domain Representation of Signals And Systems: The discrete time Fourier transform, The frequency response, The transfer function, Discrete Fourier series, Discrete Fourier transform, Computation of DFT, Linear convolution using DFT, The z-transform, The region of convergence of z transform

Structures for Discrete Time Systems: Block diagram and signal flow representation of constant coefficient, linear difference equation, Basic structures for IIR systems, Basic structures for FIR systems, Lattice structures, Effects of coefficient quantization, Effect of round off noise in digital filters, Zero-input limit cycles

Filter Design Techniques: Design of discrete time IIR filters from continuous time filters, Design of FIR filters by windowing, Optimum approximation of FIR filters, linear phase filters

Text Book:

1. Digital Signal processing A computer Based Approach by S.K.Mitra; 3rd Edition; McGraw Hill, 2007

Reference Books:

1. Digital Signal Processing by Proakis and Manolakis; 3rd Edition ; Pearson Education 2006
2. Digital Signal Processing by Ashok Ambardar Thomson Learning 2011
3. http://www.nptel.iitm.ac.in/
4. www.ocw.mit.edu

EEU703 ELECTIVE-I
(B) ADVANCED MICROPROCESSOR

Teaching Scheme: 03 L + 00 T Total: 03 Credit: 03
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2 Hrs.30 min.

8086 Microprocessor Architecture - Segmented Memory - Addressing Modes - Instruction Set - 8086 Assembly Language Programming - 8087 Numerical Data Processor Architectural details - Data types - Floating point Operations - 8087 Instructions.

Architectural details of 80386 Microprocessor - Special registers - Memory management - Operation in protected mode and virtual 80386 mode - Memory paging mechanism - Special instructions of 80386 - Architectural details of 80486 - Special registers - Additional instructions - Comparison of 80386 and 80486 processors.

Introduction to Pentium Processor - Architectural features - Comparison with the workstations - Branch prediction logic - cache structure. - Special Pentium Registers. Memory management - virtual mode of operation - Comparison with the previous processors. Features of Pentium-II, Pentium-III and Pentium Pro-processors.

RISC Microprocessors – RISC Vs CISC – RISC Properties – DEC Alpha AXP Architecture - Power PC – Architecture - Programming Model – Data Types – Addressing Modes – Instruction Set. Sun SPARC – Architecture – Data Types – Instruction Sets - Features of MIPS, AMD Microprocessors

Text Books:

1. Barry B Brey “Intel Microprocessors : 8086/88, 80186/188, 80286, 80386, 80486, Pentium, Pentium – II, Pentium – III and Pentium – IV, Architecture, Programming & Interfacing”, Pearson Education, 2003

Reference Books:

1. Badri Ram, “Advanced Microprocessors and Interfacing”, Tata McGraw Hill.
2. A.K. Ray & K.M. Bhurchandi, “Advanced Microprocessors & Peripherals, Architecture,

EEU703 ELECTIVE-I
(C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS

Teaching Scheme: 03 L + 00 T Total: 03 **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Graph of a power system, incidence matrices, primitive network, formation of network matrices by singular transformation

Representation of power system for computerized analysis: mathematical model of synchronous generator for steady state and transient analysis, transformer with tap changer, phase shifter, transmission line, and loads.

Algorithm for formation of bus impedance matrix for systems without mutual coupling, modification for changes in the network. Incidence and network matrices for three phase network, transformation matrices, algorithm for formation of bus impedance matrix for three phase networks.

Short Circuit Studies: Symmetrical component, Thevenin's theorem and short circuit analysis of multi-node power systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced faults.

Load Flow Analysis: Types of buses, load flow equations, power flow solution through GS and NR methods, decoupled and fast decoupled methods, sparsity.

Transient Stability Analysis: Including synchronous machines, system network and loads, solution of swing equation by Euler's, Euler's modified and RK methods

Economic Load Scheduling: Unit commitment, transmission loss, load scheduling considering transmission losses, unit commitment by dynamic programming method.

Text Books

1. Computer Methods in Power System Analysis, G.W. Stagg & A.H.El-Abiad, McGraw Hill 2003
2. Power System Analysis, Hadi Saadat, TMH 2004

References

1. Modern Power System Analysis (3rd Edn.), Kothari & Nagrath TMH.2004
2. Power System Analysis and Design, B. R. Gupta,
3. Computer Techniques in Power System Analysis, M. A.Pai, TMH
4. Advanced Power System Analysis and Dynamics, L. P. Singh WEL 2002.
5. http://www.nptel.iitm.ac.in/
6. www.ocw.mit.edu

EEU703 ELECTIVE-I
(D) POWER SYSTEM OPERATION AND CONTROL

Teaching Scheme: 03 L + 00 T Total: 03 Credits: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Introduction-System load – variation, load characteristics – load curves and load-duration curves, load factor, diversity factor, load forecasting, simple techniques of forecasting, basics of power system operation and control, reserve margin, load-frequency control, voltage control, Hydrothermal coordination.

Economic Operation and Unit Commitment problem – : Meaning of optimum scheduling, UCP and LSP, Input – Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost, Methods of obtaining incremental fuel costs, Conditions for incremental loading, Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Transmission loss as a function of plant generation: Calculation of loss co-efficient (Two plant system),Incremental transmission loss, Optimum scheduling of generation between different plants including transmission loss, Concept and significance of penalty factor, Automatic load dispatch: Operation and Functions.

Generator Control Loops: Concept of real and reactive power, Effect of real and reactive power on system parameters, Philosophy of real and reactive power control, Basic generator control loops.

Automatic Voltage Regulator (AVR): Functions of AVR, Types of Exciter, Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Automatic Load Frequency Control: Automatic generation control (AGC), Speed governing system, Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load, Transfer function representation of an isolated generator, Static performance of speed governor , Closing of ALFC loop.

Control Area: Meaning, Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results, Secondary ALFC loop, Integral Control, Pool operation, Tie-line Modeling, Two area system – Dynamic response, Tie-line bias control.

Text Books

1. Electric Energy Systems Theory: An Introduction, O. L. Elgerd, Second edition, McGraw-Hill Book Comp. N.Y. 1987.

2. Power System Analysis, Hadi Saadat, WCB/McGraw-Hill International Edition 1999

References

1. Modern Power System Analysis, I. J. Nagrath, D. P. Kothari, Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi. 2000

2. Economic Operation of Power System, L. K. Kirchamayor Wiley Eastern Pvt. Ltd., New Delhi 2007

3. http://www.nptel.iitm.ac.in/

4. www.ocw.mit.edu

EEU 704 INTERDISCIPLINARY ELECTIVE
(A) ELECTROMECHANICAL ENERGY CONVERSION

Teaching Scheme : 03 L + 00 T Total: 03 Credit: 03
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2 Hrs.30 min

Electric and Magnetic Field Calculations: Magnetic circuit calculations for devices and machines, Theory of electrostatic and magnetic fields, Fundamental equations, Fields of simple geometries.

Electromechanical Energy Conversion: Energy storage in singly and multiply-excited systems, Mechanical force and stored energy, Electromechanical transducers and their analysis, Reluctance type devices, Energy dissipation- resistance, eddy current, hysteresis and dielectric loss, Lagrange's equation.

Induced Voltage, Armature Reaction and Torque: Induced voltage in windings of ac and dc machines, Armature reaction- MMF of a single coil and uniformly distributed conductors, Rotating magnetic fields in ac machines, Torque in dc and three-phase ac machine, Torque of mutually coupled coils.

Dynamics of Electric Machines: Dynamics of dc machines, Dynamic response of first and second order linear systems, Voltage regulation of separately-excited dc generator, Speed control of separately-excited dc motor, Synchronous-machine dynamics, Parallel operation and synchronizing of alternators.

TEXT BOOKS

1. Electro-mechanical energy conversion with dynamics of machines, Rakosh Das Begamudre, Second Edition, New Edge International Publishers, New Delhi.-2008
2. Electric Machines, I J Nagrath and D P Kothari, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 2003

REFERENCE BOOKS

1. Principles of Electro-mechanical energy conversion, Del Toro V, Prentice-Hall, Englewood Cliffs, N J.
2. Electric Machinery, Fitzgeral A E and Kingslley C, 1st to 4th Editions, McGraw-Hill Book Company.
3. http://www.nptel.iitm.ac.in/
4. www.ocw.mit.edu

EEU 704 INTERDISCIPLINARY ELECTIVE
(B) ROBOTICS AND AUTOMATION

Teaching Scheme : 03 L + 00 T Total: 03 **Credit: 03**
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min

Introduction: Robot definition, Robot classification, Robotic system components. Notations, Position definitions, Coordinate frames, Different orientation descriptions, Free vectors, Translations, rotations and relative motion, Homogeneous transformations, Spatial Descriptions and Transformations.

Manipulator Kinematics and Mechanics of Robot Motion: Link coordinate frames, DenavitHartenberg convention, Joint and end-effectors, Cartesian space, Forward kinematics transformations of position, Inverse kinematics of position, Translational and rotational velocities, Velocity Transformations. Manipulator Jacobian. Forward and inverse kinematics of velocity, Singularities of robot motion, Static Forces, Transformations of velocities and static forces, Joint and End Effectors force/torque transformations.

Manipulator Dynamics: Trajectory Planning, Control. Lagrangian formulation, Model properties, Newton-Euler equations of motion, Joint-based motion planning, Cartesian-based path planning. Independent joint control, Feed-forward control, Inverse dynamics control, Robot controller architectures, Implementation problems.

Automated Manufacturing Systems: Introduction, Manufacturing systems, Performance measure, Computer controlled machines, Material handling systems, Plant layout. Flexible manufacturing system, Computer control system.

Texts Books

1. Introduction to Robotics: Machines and Control, John J. Craig, 3rd Edition, Prentice Hall -2004

References

1. Modeling Identification & control of Robot , W.Khalil & E.Dombare , McGraw Hill -2005
2. http://www.nptel.iitm.ac.in/
3. www.ocw.mit.edu

EEU704 INTERDISCIPLINARY ELECTIVE

(C) ENERGY EFFICIENCY IN ELECTRICAL UTILITIES

Teaching Scheme: 03 L + 00 T Total 03 **Credit: 03**
Marking Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Electrical systems:
Introduction to Electrical energy systems, Tariff and economic considerations, T & D losses, Electrical load and various factors, Power factor and its introductory improvement techniques, Energy Efficient Technologies in Electrical Systems

Electric Motors and Drives:
Energy Efficient Motors, Factors affecting Energy efficiency of a motor
Introduction to power electronic controllers, soft starters and block diagrams of stator voltage and stator frequency controlled three phase induction motor drives, block diagrams of controlled rectifier and chopper fed dc shunt motor

Fans and Blowers:
Types, efficient system operation, Capacity selections, Performance assessment of fans and blowers, Energy conservation opportunities

Pumping systems:
Types, Performance evaluation, efficient system operation, Energy conservation opportunities in pumping systems

Lighting systems:
Basic terms of lighting systems, recommended illumination level, Methodology of lighting systems, energy efficiency study, Energy conservation opportunities

DG Set and UPS systems:
Introduction, Selection and capacity factor, Operational parameters, Performance assessment of DG Systems, Energy conservation opportunities
Block diagram and working of UPS

Energy Efficiency in Renewable Energy Systems:
Energy efficiency in solar and wind energy systems

Text Books

1) Energy Efficiency in Electrical Utilities, BEE Guide Books, 2010
2) Utilization of Electrical Energy, E.O. Taylor, Orient Blackswan Publishers Pvt. Ltd., New-Delhi, Reprint 2008

References

1) Handbook of Energy Engineering, Albert Thumann, D. Paul Mehta, Sixth Edition, The Fairmount Press Inc., 2008
2) TEDDY Year Book Published by Tata Energy Research Institute (TERI)

EEU705 SWITCH GEAR AND PROTECTION LAB

Teaching Scheme : 02 P Total: 02 **Credit: 01**
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course EEU701) from the list or otherwise.

Minimum eight experiments should be performed.
1) Characteristics of Miniature circuit breaker
2) Characteristics of rewritable fuse
3) Operation of Parallel feeder
4) Combined protection for generator transformer unit
5) Various circuit breakers
6) Over current relay characteristics
7) Earth fault relay
8) Generalized protection scheme

Note:-
ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.
ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions.

EEU706 LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Teaching Scheme : 02 P Total: 02 **Credit: 01**
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs

Minimum Ten experiments based on syllabus of EEU 702 Linear & Digital Integrated circuits. Representative list of experiments is as follows.

1. Inverting amplifier using IC 741 and its frequency response.
2. Non-inverting amplifier using IC 741 and its frequency response.
3. Summing amplifier- to build summing amplifier in inverting and non-inverting mode.
4. Measurement of Op-amp parameters: Input offset voltage, input bias current. Input offset current, CMRR.
5. Measurement of slew rate.
6. To build voltage comparator and to generate the waveforms on CRO.
7. Voltage limiter-to build Voltage limiter and to generate the output waveforms.
8. Differentiator -to build and to generate the output waveforms for various values of R and C.
9. Integrator -to build and to generate the output waveforms for various values of R and C.
10. Precision rectifiers-to build precision rectifiers and to generate the output waveforms
11. To verify different logic gates.
12. Realization of half adder using gates.
13. Realization of half substractor using gates.
14. Implementation of full Adder circuit using gates.
15. To study Flip-Flops.
16. To Study counters.

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment Formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions

EEU707 ELECTIVE I LAB

(A) DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme: 02 P Total: 02 **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs

Representative list of experiments is as follows. Minimum 10 experiments to be performed.

1. To study basic discrete-time signals and operations.
2. To learn how to represent and implement discrete-time signals using MATLAB
3. To study convolution and correlation of discrete-time signals
4. To learn how to implement the two operations using MATLAB
5. To study the sampling principle and the effect of sampling on the frequency-domain quantities
6. To study and investigate the Discrete Fourier Transform
7. To learn how to implement the operation using MATLAB
8. To learn how to analyze discrete-time signal using DFT
9. To learn how to synthesize discrete-time signal using IDFT
10. To study and investigate the Fast Fourier Transform algorithm.
11. To learn how to analyze discrete-time signal using FFT
12. To learn how to synthesize discrete-time signal using IFFT
13. To determine specifications needed for FIR filter design.
14. To learn how to design the FIR filters using window techniques.
15. To learn how to implement the designed FIR filter by MATLAB.
16. To determine specifications needed for IIR filter design.
17. To learn how to design and implement IIR filters using MATLAB.

Note:-
ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment Formats, A and B.
ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions

EEU707 ELECTIVE I LAB

(B) ADVANCED MICROPROCESSOR LAB

Teaching Scheme: 02 P Total: 02 **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs

Minimum Ten program must be entered and executed covering the Entire Syllabus of EEU703, (Advanced Microprocessor)

LIST OF MICROPROCESSOR LAB EXPERIMENTS

1. Write an ALP to transfer a block of N word from source block to the destination block, without overlap.
2. Write an ALP to transfer a block of N word from source block to the destination block, with overlap.
3. Write an ALP to interchange a block of N-bytes / words.
4. Write an ALP to add the two given N-bit multi precision numbers {N≥32 bits}.
5. Write an ALP to multiply two 32-bits unsigned hexadecimal numbers.
6. Write an ALP to divide an unsigned N-bit hexadecimal number by an unsigned Hexadecimal byte (N to be specified > 16bits).
7. Write an ALP to check whether the given 8-bit data is a. Positive or Negative. b. Odd or even. c. Find the logical 1's and 0's in the given data.
8. Write an ALP to find the HCF of two 16-bit unsigned numbers.
9. Write an ALP to find the LCM of two 16-bit unsigned integers.
10. Write an ALP to find the factorial of a number N (N≤9).
11. Write an ALP to convert 16-bit BCD number to its Hexadecimal equivalent.
12. Write an ALP to convert a given 16-bit Hexadecimal number to its BCDequivalent. Display the result.
13. Write an ALP to find the square and cube of a given 32-bit hexadecimal number.
14. Write an ALP to add two strings of ASCII digits. (Length to be specified).
15. Write an ALP to subtract two strings of ASCII digits (Length to be specified).
16. Write an ALP to multiply a string of ASCII digits by a single ASCII digit.
17. Write an ALP to divide a string of ASCII digits by a single ASCII digit.
18. Write an ALP to transfer the given string data to the destination using stringprimitive instructions.
19. Write an ALP to reverse a string and check whether the given string is apalindrome or not.
20. Write an ALP to sort the given set of 16-bit unsigned integers inascending/descending order using Bubble sort algorithm.
22. Write an ALP to sort the given set of 16-bit unsigned integers inascending/descending order using Insertion sort algorithm

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment Formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions

EEU707 ELECTIVE I LAB

(C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS LAB

Teaching Scheme : 02 P Total: 02 **Credit: 01**
Evaluation Scheme : 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU703 Elective I (C) (Computer Methods in Power System Analysis) using MATLAB/ SIMULINK/ Power world Simulator. Representative list is as follows –

01. To Form Y_{bus} matrix using singular transformation.
02. To Form Y_{br} matrix using singular transformation.
03. To Form Z_{loop} matrix using singular transformation.
04. To Form Z_{bus} matrix using step-by-step method.
05. To Form Y_{bus} matrix using step-by-step method.
06. To perform load flow analysis using Gauss-Seidel method.
07. To perform load flow analysis using Newton-Raphson method.
08. To perform short circuit analysis for a particular type of fault (LG / LL / LLG / LLL / LLLG)
09. Solution of swing equation by Euler's method.
10. Solution of swing equation by Euler's modified method.
11. Solution of swing equation by RK2 method.
12. Unit commitment using equal incremental cost method.
13. Unit commitment using dynamic programming method.
14. Load scheduling considering transmission losses.

Note:
ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment Formats, A and B.
ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions

EEU707 ELECTIVE I LAB

(D) POWER SYSTEM OPERATION AND CONTROL LAB

Teaching Scheme: 02 P Total: 02 **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU703(D) Elective I Power System Operation and Control using MATLAB/ SIMULINK / Power world Simulator. Representative list is as follows –

1. Unit commitment using equal incremental cost method.
2. Unit commitment using dynamic programming method.
3. Load scheduling considering transmission losses.
4. Visit to a Load Dispatch centre
5. Model of speed governing system
6 .Generator Control Loops
7. Automatic Voltage Control
8. Static performance of speed governor
9. Dynamic response of speed governor
10. Automatic Load Frequency Control

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment Formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions.

EEU708 PROJECT PHASE - I

Teaching Scheme : 04 P Total: 04 **Credit: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

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1 In general, a group of 3-6 students should be allowed to complete the project on Approved topic.
2 Preferably more than 25 % projects shall be Industry / Research based / oriented.
3 Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
4 Students should finalize the topic for the project after literature survey in consultation with the Guide.
5 The **Synopsis/Abstract** on the selected topic should be submitted to the H.O.D. for approval.
6 On approval of the topic, students should initiate the topic based work.
7 Approximately more than 30% work(of the total quantum) should be completed by the end of VII semester.
8 At the end of semester, each batch should submit the progress report in following format:
Title
Introduction
Concept
Work completed
Work to be completed
References
9 For uniform and continuous evaluation, the Evaluation Committee comprising of the Guide, Project Course Coordinator and Expert appointed by the Program Head will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted by the panel of examiners.

EEU709 SEMINAR

Teaching Scheme : 02 P Total: 02 **Credit: 02**
Evaluation Scheme : 50 ICA **Total Marks: 50**

1. Student shall select a topic for seminar which is **not covered in curriculum**.
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:
   Introduction
   Literature Survey
   Concept
   Functional and Technical Details
   Future scope
   Applications
   Comparison with similar topics / methods
   References
5. Student shall deliver a seminar based on submitted report. The presentation and oral examination on selected seminar topic shall be assessed by pannel of examiners

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Seminar Topic and the knowledge acquired. The seminar shall be assessed by the examiner panel consisting of Project Guide, Course Coordinator Seminar and Expert appointed by Program Head.

EEU710 INDUSTRIAL TRAINING/VISIT

Teaching Scheme: 00 Total: 00 Credits: 01
Evaluation Scheme: 50 ICA Total Marks: 50

Industrial Training shall have an option of Industrial Visit.
Industrial Training: List of renowned industries shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal and with the consultation of Industry personnel, 02 weeks trainings shall be arranged during the vacations (after the VI semester). The students may be permitted to undergo the trainings of 02 weeks as per their choices for which all the official formalities will be completed by the students under the guidance of course coordinator. The students shall submit the report based on the Industrial training to the course coordinator which will be evaluated during the VII semester
Industrial Visit: An Industry Visits to minimum three industries shall be arranged for the students unable to complete the Industrial Training. The visit shall be arranged preferably during the vacation period. However in non-availability of permission for the visit during vacation period, same may be

arranged during the regular VII semester. The students will be required to submit the report based on the Industrial Visit which will be evaluated by the course coordinator

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training/visits and knowledge / skill acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

EEU711 INDUSTRIAL LECTURE-II

Teaching Scheme: 01 L — Total: 01 Credits: 01
Evaluation Scheme: 25 ICA — Total Marks: 25

List of renowned persons from industry shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal, Minimum twelve Industrial lectures shall be arranged, preferably once a week, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors covering the various aspects.

The assignments based on the Industry Lecture-I and Industry Lecture-II will be evaluated during VII semester

Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.

Students shall submit the report based on lectures.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the lectures and knowledge acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

EEU712 SELF STUDY-III

Teaching Scheme: 00 P Total: 00 — **Credit: 02**
Evaluation Scheme: 25 TA — **Total Marks: 25**

1] Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester

2] One faculty member shall be appointed as course coordinator for Self Study - III and his/her work load shall be considered as 1 hr/week.

EEU801 POWER SYSTEMS STABILITY

Teaching Scheme: 03 L + 00 T **Total: 03 Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min

Basics of Power System Stability: Concept of stability, types of stability, modeling of power system components for stability studies, power system dynamics, swing equation, factors affecting stability and recent trends for improving stability

Small Disturbance Stability: Steady state stability of two-machine system, power angle curve, stability criterion, definition and computation of SSSL by analytical and graphical methods, effect of inertia, saliency, saturation, governor action and SCR on SSSL

Large disturbance Stability: Single machine infinite bus (SMIB) system, classical model, equal area criteria technique and its applications to various types of disturbances, point by point method for solving swing equation

Excitation System: Effect of excitation system on generator power limit, various types of excitation systems, transformation model of excitation system

Text Books

1. Power System Analysis, Hadi Sadat, Tata McGraw Hill, 2005
2. Modern Power System Analysis, Nagrath and Kothari, McGraw Hill, 2005

References

1. Power System stability and Control, P.Kundur, McGraw Hill, New York, 2007
2. Power System Stability, E.W.Kimbark, Vol 1 and 3 , Dover Publications 1999
2. Power System Dynamics, Stability and Control, K.R.Padiyar Interline Publishers, Ban galore, 2007
3. Power System Control and Stability, P.M Anderson and A.A. Fouad, McGraw Hill, 2004
4. http://www.nptel.iitm.ac.in/
5. www.ocw.mit.edu

EEU802 ELECTRICAL DRIVES AND CONTROL

Teaching Scheme: 03 L + 00 T **Total: 03 Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min

Introduction to Electrical Drives: Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

Starting and Braking of Electrical Drives: Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, braking of d c and induction motors.

DC Drives: Single phase half, full and dual converter based d c drives - Circuit configurations, inputoutput waveforms, Calculation of torque, speed, power factor, firing angle etc. Torque-Speed characteristics. DC Chopper based d c drives - Circuit configurations, input-output waveforms, Calculation of torque, speed, duty cycle etc. Torque-Speed characteristics.

Induction Motor Drives: Scalar control of induction motor – stator voltage and stator frequency control using stator voltage controllers and inverters – circuit configurations, calculation of current, torque, speed etc. Torque-Speed characteristics. Slip power recovery schemes – rotor chopper / inverter control of induction motor - Circuit configurations and theoretical concepts only.

Industrial Applications: Electrical drives system for rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

Text Books

1. Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, 2005
2. Electric Drives-Concepts and Applications, V.Subrahmanyam TMH Pub, 2004
3. A first course on Electrical Drives, S.K.Pilley Wiley Eastern Pub, 2002
4. Electric Drives, De and Sen PHI Pub, 1999

References

1. Thyristor DC Drives" P.C.Sen John Wiley & Sons, 1981.
2. Power Electronic Control of AC Motors", JMD Murphy & FG Turnbull, Pergamon Press, 1988.
3. Power Semiconductor Controlled Drives", G.K. Dubey PH Int., 1989.
4. Power Semiconductor Drives" Deewan, Straughan & Slemon John Wiley & Sons.
5 http://www.nptel.iitm.ac.in/
6. www.ocw.mit.edu

EEU803 ELECTIVE-II

(A) MULTIRATE DSP AND WAVELET

Teaching Scheme: 03 L + 00 T Total: 03 **Credit: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Beginning with some practical situations, which call for multi-resolution / multi-scale analysis - and how time-frequency analysis and wavelets arise from them. Examples: Image Compression, Wideband Correlation Processing, Magnetic Resonance Imaging, Digital Communication.

Piecewise constant approximation: Haar wavelet, Building up the concept of dyadic Multi-resolution Analysis (MRA), Relating dyadic MRA to filter banks, review of discrete signal processing. Elements of multi-rate systems and two-band filter bank design for dyadic wavelets.

Families of wavelets: Orthogonal and biorthogonal wavelets. Daubechies' family of wavelets in detail. Vanishing moments and regularity. Conjugate Quadrature Filter Banks (CQF) and their design. Dyadic MRA more formally. Data compression - fingerprint compression standards, JPEG-2000 standards.

The Uncertainty Principle and its implications: the fundamental issue - the problem and the challenge that nature imposes. The importance of the Gaussian functions: the Gabor Transform and its generalization; time, frequency and scale - their interplay. The Continuous Wavelet Transform (CWT). Condition of admissibility and its implications. Application of the CWT in wideband correlation processing.

DWT: Discretization in steps. Discretization of scale - generalized filter bank. Discretization of translation - generalized output sampling. Discretization of time/ space (independent variable) - sampled inputs.

Variants of the wavelet transform and its implementational structures: An exploration of applications (this will be a joint effort between the instructor and the class). Examples: Transient analysis; singularity detection; Efficient signal design and realization: wavelet based modulation and demodulation; Applications in mathematical approximation; Applications to the solution of some differential equations; Applications in computer graphics and computer vision; Relation to the ideas of fractals and fractal phenomena.

Text Book:

1. P. P. Vaidyanathan, “Multirate Systems and Filter Banks”, Pearson Education, Low Price Edition, ISBN 81 – 7758 – 942 – 3.

Reference Books:

1. Howard L. Resnikoff, Raymond O. Wells, “Wavelet Analysis: The Scalable Structure of Information”, Springer, 1998: available in Indian Edition.
2. Raghuveer M. Rao, Ajit S. Bopardikar, “Wavelet Transforms: Introduction
3. K. P. Soman, K. I. Ramachandran, "Insight into Wavelets - From Theory to Practice", Prentice Hall of India, Eastern Economy Edition, ISBN Number 81-203-2650-4.
4. Michael W. Frazier, “An Introduction to Wavelets through Linear Algebra”, Springer, ISBN 3-540-780-75-0, c 1999,
5. www.ocw.mit.edu

EEU803 ELECTIVE-II

(B) HIGH VOLTAGE ENGINEERING

Teaching Scheme: 03 L + 00 T Total: 03 **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Mechanism Of Breakdown In Gases: Classification of insulating materials. Gases as insulating media, Ionization & decay process, breakdown in gases, Townsend's law. The streamer mechanism of spark Paschen's law, corona discharge, electronegative gases

Breakdown In Liquid And Solid Dielectrics : Breakdown in pure and commercial liquids, Solid Dielectrics and composite dielectrics, High Voltage bushings, Guarding, Shielding, Field Plotting.

Lightning and Switching over Voltages and Protection: Lightning strokes to lines and towers, mechanism & characteristics. Protection of transmission lines from lightning, Lightning Arrestors. Insulation to co-ordination of HV and EHV transmission line, Power system and substation.

High Voltage and Current Generation: Generation of High D.C, A.C. and Impulse voltages, Standard impulse wave shapes, Switching Surges , High Impulse Generator

High Voltage And Current Measurement: Peak voltage, Impulse voltage and High Direct current Measurement methods, Non-destructive measurement and testing, High Voltage dielectrics Loss and capacitance measurement, Radio Frequency and partial discharge measurement.

High Voltage Testing: Basic Terminology, Testing – Insulation, Bushings, Cables, Transformers, Surge Diverters and Isolators, Electric Shock and threshold current

Text Book

1. High Voltage Engineering, Naidu M.S. and Kamaraju V Tata McGraw Hill Pub. Co. New Delhi Third Edition

References

1. High Voltage Engineering, E. Kuffel and W.S. Zaenglo, Pergamon Press
2. EHV AC Transmission Engineering, Rokosh Das Begamudre, Wiley Eastern Ltd. New Delhi.
3. High Voltage Engineering, D.V.Razevig, Khanna Pub. New Delhi
4. http://www.nptel.iitm.ac.in/
5. www.ocw.mit.edu

EEU803 ELECTIVE-II

(C) NETWORK SYNTHESIS

Teaching Scheme: 03 L + 00 T Total: 03 **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Synthesis of one port network: Introduction, Hurwitz polynomial, Routh's criterion, positive real function, Frequency response of reactive one-ports, synthesis of reactive one-ports by Foster's and Cauer method, synthesis of R-L network by Foster's and Cauer method, synthesis of R-C network by Foster's and Cauer method.

Passive Filters: Introduction, classification of filter networks, characteristic impedance in the pass and stop bands, constant-K- low pass, high pass, band pass and band stop filters, principles of m-derived filters, the m-derived T and π sections, m-derived- low pass, high pass and band pass filters, terminated m-derived half sections, impedance matching of filters, design of composite filters.

Attenuators: Introduction, Symmetrical attenuators – T type, π type, bridged-T and lattice attenuators, Asymmetrical attenuators – T type, π type, L type attenuators.

Equalizers: Introduction, Inverse network, series equalizer, full series equalizer, shunt equalizer, constant resistance equalizer, bridge T-attenuation equalizer, lattice attenuation equalizer, lattice phase equalizer.

Active filters: Introduction, Filter function definitions, second order Sallen-key filters – active low pass, active high pass and active band pass filters, cascading of active filters, Butterworth filters – first order low pass, second order low pass, second order band pass and high pass filters, Chebyshev filters, switched capacitor filters – resistance simulation, realization of integrator, realization of gain stages, realization of one pole section.

Digital Filters: Digital filter as a system, digital filter networks, discrete time elementary functions, realization of digital filters – direct realization, direct canonic realization, cascade realization, parallel realization, ladder realization, discrete Fourier transform.

Text Books

1. An Introduction to Modern Network Synthesis, M. E. Van Valkenberg
2. Circuits and Networks – Analysis and Synthesis, A. Sudhakar & S. S. Palli (4^{th} Edn.), TMH 2011.

References

1. Engineering Network Analysis and Filter Design, G. G. Bhise, P. R. Chadha & D. G. Kulshreshtha, Umesh Publications 2004.
2. Circuit Theory – Analysis and Synthesis, A. Chakrabarti, Dhanpatrai & Co. 2001.
3. Networks and Systems (2^{nd} Edn.), D. Roy Choudhary, New Age International Publishers, 2010

EEU803 ELECTIVE-II

(D) ARTIFICIAL NEURAL NETWORK

Teaching Scheme: 03 L + 00 T Total: 03 **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Introduction: Introduction to Artificial Intelligence, Artificial Neural Network (ANN), Characteristics of ANN

Biological neurons: Function of single biological neuron, Comparison of brain and computer, Comparison between Artificial and Biological neural network.

Basic terminology related to artificial neuron, Basic building blocks of ANN. Network architecture, setting of weights, Activation functions.

Fundamental Models of ANNs and Learning Processes: McCulloch Pitt's neuron model, Hebb net. Concept of Learning with a Teacher, Learning without a Teacher, Different Learning rules such as Hebbian learning rule, Perceptron learning rule, Delta and extended delta learning rule, Competitive learning rule, outstar learning rule, Boltzman learning rule. Concept of Linear separability

Single Layer Network and Multi-layer Network : Single Layer Perceptron: architecture – training algorithm, Application Procedure, different performance indices, different training stopping conditions and their limitations, learning curves.

Adaline and Medaline Networks: Architecture, Training and Application Algorithms

Back Propogation Network: Architecture, Back propagation Learning algorithm, Selection of parameters, Concept of learning rate, momentum coefficient, Local and global minima, Advantages and disadvantages of BPN.

Radial Basis Function Network: Architecture, Training algorithm

Self Organizing Feature Map: Concept of clustering, Concept of winner unit, methods for determining the winner unit, Kohonen self organizing Feature Map (SOFM).

Applications of ANN: Applications of ANN in bioinformatics, Forecasting (Regression), Pattern recognition (Classification)

Text Books

1. Introduction to Neural Network using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, Tata McGraw-Hill, 2009
2. Neural Networks: A Comprehensive Foundation, Simon Haykin, 2nd Edition,Pearson Education 2007

References

1. Understanding Neural Networks and Fuzzy Logic – Basic Concepts and Applications, S. V. Kartalopoulos, PHI, 2005
2. Introduction to Neural Network, Anderson J.A., MIT press, Cambridge 2006
3. Neural Network, A classroom Approach, Satish Kumar, McGraw Hill, 2008
4. http://www.nptel.iitm.ac.in/
5. www.ocw.mit.edu

EEU804 ELECTIVE-III

(A) HVDC AND FACTS

Teaching Scheme: 03 L + 00 T Total: 03 **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

DC Power Transmission Technology: Introduction, comparison of AC & DC Transmission, application of DC transmission, Description of DC transmission systems, planning & modern trends.

Analysis of HVDC Converters :3-pulse, 6-pulse,12-pulse converters , converters station and terminal equipment , commutation process, rectifier & inverter operation, equivalent circuit for converters , simplified analysis of Graetz circuit.

Control of Converters and HVDC System Control: Firing angle control, Current and extinction angle control, starting and stopping of DC link, power control, higher level Controllers, Converter faults and protection: Introduction, Converter faults, protection against over current, over voltage in a converter station, surge arrestors. Smoothing reactor.

Multi Terminal DC Systems: Potential applications of MTDC systems, types of system, operation & control and protection of MTDC systems. Parallel operation of HVDC

Flexible AC Transmission Systems (FACTS): Steady state and dynamics problems in AC systems, Introduction of Flexible AC transmission systems (FACTS) Necessity & objectives of FACTS,

Basic Types of FACTS Controller: Description of static var compensation (SVC), Thyristor controlled series compensation (TCSC), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPSC)

Text Books

1. HVDC Transmission, Padiyar K.R, Wiely Eastern Ltd; New Delhi
2. Understanding FACTS: Concepts and Technology of flexible AC transmission system, Hingorani N. G. & Gyugyi L., IEEE press 2000.

References

1. Direct Current Transmission, Kimbark E.W., John Wiley &Sons,1999
2. http://www.nptel.iitm.ac.in/
3. www.ocw.mit.edu

EEU804 ELECTIVE-III

(B) HIGH VOLTAGE TRANSMISSION

Teaching Scheme: 03 L + 00 T Total 03 **Credit : 03**
Marking Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks:100**
Duration of ESE: 2 Hrs.30 min.

Extra high voltage AC Transmission: Introduction to EHV-AC transmission, transmission line trends & preliminary aspects, standard transmission voltages-power handling capacities and line losses-mechanical aspects.

Electrostatic field of EHV lines, electric shock & threshold currents, capacitance of long object, Effect of Electrostatic field on Human, Animal.

Over voltages in EHV system: origin & causes, over voltage caused by switching operations, over voltage caused by interruption of low inductive current, over voltage caused by interruption of capacitive currents, ferro-resonance overvoltage Power frequency voltage control , shunt & series compensation .

Lightning: Lightning strokes, Lightening stroke to tower and midspan, Insulation coordination based on lightning.

High Voltage DC Transmission: Introduction to HVDC, Comparison of AC-DC Transmission, Types of HVDC Systems, limitation of HVDC Transmission, planning & modern trends,

Converters Station and Terminal Equipment: Analysis of HVDC Converters: 3-pulse, 6-pulse, commutation process, rectifier & inverter operation, Ground return, Circuit breaking

Converter faults and protection: Introduction, Converter faults, protection against over current ,over voltage in a converter station, surge arrestors. Smoothing reactor, Harmonics and filters

Parallel operation of HVDC and HVAC.

TEXT BOOKS

1. "Extra High Voltage AC Transmission Engineering", Rakosh Das Begamudre ,New Age International(P) Ltd
2. " HVDC Transmission" Wiely Eastern Ltd;" K.R.Padiyar ,New Delhi
3. "HVDC Transmission", S.Kamakshaiah,V.Kamaraju, TMH,2011

REFERENCE BOOKS

1 "AC-DC Power System Analysis", Arrillaga, IEE London, 1998.
2 "Direct Current Transmission", Kimbark E.W, John Wiley &sons
3 www.nptel.iitm.ac.in
4 www.ocw.mit.edu

EEU804 ELECTIVE-III

(C) POWER QUALITY AND DEREGULATION

Teaching Scheme: 03 L + 00 T — Total: 03 Credits: 03
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE — Total Marks: 100
Duration of ESE: 2 Hrs.30 min

Basic Concepts of Power Quality: Power quality problems in distribution systems, definitions, power quality standards, Harmonics, Harmonic creating loads & its modeling

Mitigation of Power Quality Problems: Harmonics propagation, series and parallel resonance, harmonic power flow, mitigation of harmonics, filters, active filters, shunt and series hybrid filters, voltage sag and swells, voltage flicker, power electronics conditioners

Fundamentals of Restructured System: History of power system restructuring, concept of power system deregulation, regulation vs. deregulation, entities in deregulated system, Indian scenario

Models of Restructuring: PoolCo and bilateral contractual models & power exchange, ISO based markets models, market architecture, day ahead and hour ahead markets.

Transmission Open Access Issues: Available Transfer Capability (ATC) - definition and methods of determination, transmission network congestion, congestion management techniques

Text Books:

1. Electrical Power Systems Quality, Dugan Roger, McGraw-Hill Edition 2002
2. Operation of restructured power system, Bhattacharya Kankar, IEEE Publication.2001

Reference Books:

1. Power System Restructuring, Lai Lee
2. Power Quality Sags and Interruption, Mach Boolan, John Wiley
3. Power Electronics, Ned Mohan John Wiley and Sons -2003
4. Electrical Energy Utilization and Conservation, S.C. Tripathi (TMH Pub.)-2003
5. http://www.nptel.iitm.ac.in/
6. www.ocw.mit.edu

EEU804 ELECTIVE-III

(D) STATISTICAL SIGNAL PROCESSING

Teaching Scheme: 03 L + 00 T Total: 03 **Credit: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2 Hrs.30 min.

Probability: Sample space and events, Conditional, total probability, Independent event.

The Random Variable: The random variable concept, the definition of random variable, discrete and continuous random variable, mixed random variable, distribution function, density function.

Multiple Random Variables: Bivariate random variables, joint distributions and its properties, joint density and its properties, conditional distributions and density, statistical independence, central limit theorem.

Operations On Random Variables: Expectations, moments, functions that give moments, transformation of random variables, computer generation of one random variable, expected value of function of a random variable, jointly Gaussian random variable, sampling and some limit theorems.

Random Processes: Concept of random process, stationarity and independence, correlation functions, Poisson random process, Wiener process, power spectral density, relation between power spectral density and autocorrelation function.

Linear Systems with Random Inputs: Linear system response to random signals, system evaluation using white noise, discrete time systems, modeling of noise sources, some practical applications.

Text Book:

1. Probability, Random variables and random signal principles 4th edition, Peyton Z Peebles TMH, 2001

Reference Books:

1. Probability, Random Variables, and Stochastic Processes, Papoulis, TMH, 2003
2. http://www.nptel.iitm.ac.in/
3. www.ocw.mit.edu

EEU805 POWER SYSTEM STABILITY LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU801 POWER SYSTEM STABILITY. The Simulation is to be carried out using software like PSCAD, ETAP, MATLAB/Simulink, Power World and SimPower etc.

Representative list is as follows:

1. To find the Steady State Stability of a two machine system with and without resistance switching
2. To find the Steady State Stability of a two machine system using inductance connected in parallel with the line also without inductance and comment on stability.
3. To find the Steady State Stability of a two machine system with and without capacitance connected in parallel with the line also comment on stability.
4. To obtain the frequency of oscillations in two machine System.
5. To plot the natural response of rotor angle and frequency for two machine system.
6. Determination of maximum power without loss of synchronism using Equal area criterion.
7. To find the Transient stability limit in double circuit line when fault applied in the middle of transmission line.
8. To determine the transient stability in double circuit line when fault applied on either end.

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge/skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions.

EEU806 ELECTRICAL DRIVES AND CONTROL LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs.

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed. (The laboratory may consist of 2-3 simulation studies based on Matlab - Simulink / PSIM / PSPICE platform and one industrial visit for study of electrical drive.)

Representative List:

1. Converter controlled d c motor.
2. Chopper controlled d c motor.
3. Stator voltage controlled induction motor.
4. Stator frequency controlled induction motor.
5. Plugging / rheostatic braking of d c motor.
6. Plugging / rheostatic braking of induction motor.
7. Study of solid state / soft starters for electrical motors.
8. Study of electrical drive in any industry. (Industrial visit)
9. Simulation of 1 / 2 / 4 quadrant Converter controlled dc drive.
10. Simulation of 1 / 2 / 4 quadrant Chopper controlled dc drive
11. Simulation of open loop / closed loop V/f control of I.M.
12. Simulation of rotor chopper control of I.M.

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge/skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions

EEU807 ELECTIVE-II LAB

(A) MULTIRATE DSP AND WAVELET LAB

Teaching Scheme: 02 P Total: 02 **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **External Total Marks: 50**
Duration of ESE: 3 Hrs.

1. Use the command line functions available in the MATLAB signal processing toolbox, to simulate simple multirate DSP systems. The focus here is to be able to view in the frequency domain what is happening at each stage of a system involving upsamplers, downsamplers, and lowpass filters. All computations will be performed using MATLAB and the signal processing toolbox.
2. FIR filter design using multirate technique
3. Design of Two-Channel Orthogonal Filter bank
4. Design of Quadrature Filter Bank

EEU807 ELECTIVE-II LAB

(B) HIGH VOLTAGE ENGINEERING LAB

Teaching Scheme: 02 P Total: 02 **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **External Total Marks: 50**
Duration of ESE: 3 Hrs.

Minimum Eight Experiments must be performed covering the Entire Syllabus of EEU803 B – HIGH VOLTAGE ENGINEERING

Representative list is as follows:

1. Study of Corona
2. Determine the Breakdown voltage of paper insulator
3. Determine the Breakdown voltage of Transformer Oil
4. Generation High DC Voltage
5. Generation of High AC Voltage
6. Generation of Impulse Voltage
7. Measurement of High AC Voltage with Sphere gap and peak volt meter
8. Measurement of High DC Current
9. Measurement of High frequency and Impulse Currents
10. Measurement of DC Resistivity of conductor
11. Measurement of Dielectric Constant and Loss Factor
12. Testing of Cables
13. Testing of Insulators
14. Testing of Lightening Arrestor

EEU807 ELECTIVE-II LAB

(C) NETWORK SYNTHESIS LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU803 Elective II (C) (Network Synthesis). Representative list is as follows –

01. Foster realizations (one port) of the given function.
02. Cauer realizations (one port) of the given function.
03. Design of constant k-low pass filter.
04. Design of constant k-high pass filter.
05. Design of m-derived-T-section-low pass filter.
06. Design of m-derived- π-section-high pass filter.
07. Design of full series equalizer.
08. Design of symmetrical lattice attenuator.
09. Design of fourth order Butterworth low-pass filter.
10. Design of second order Butterworth band-pass filter.
11. Impulse response and unit step response of digital filter network.

Note:

ICA – Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

EEU807 ELECTIVE-II LAB

(D) ARTIFICIAL NEURAL NETWORK LAB

Teaching Scheme: 02 P Total: 02 Credit: 01
Evaluation Scheme: 25 ICA + 25 ESE Total Marks: 50
Duration of ESE: 3 Hrs.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU803 (D) Elective I (Artificial Neural Networks) using MATLAB/ SIMULINK. Representative list is as follows –

01. To generate a few activation functions that are used in neural networks.
02. To realize the Exclusive OR function using McCulloch-Pitts neuron.
03. To design a two input, one output perceptron to satisfy the given data.
04. To realize a Hebb net for the AND function with bipolar input and targets.
05. Pattern classification using perceptron network.
06. To realize a OR function with bipolar inputs and targets using adaline network.
07. To realize a XOR function with bipolar inputs and targets using madaline network.
08. To get XOR function (binary input and output) with momentum factor using back propagation algorithm.

Note:

ICA – Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE – The End Semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

EEU808 PROJECT PHASE - II

Teaching Scheme : 06 P Total: 06 **Credit: 06**
Evaluation Scheme : 75 ICA + 100 ESE **Total Marks: 175**
Duration of ESE: 3 Hrs.

1. Project work decided in VII semester shall be continued.
2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
3. Students shall submit the final project report in proper format as per guidelines given on the college website which shall include the work of both semesters.
4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
5. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consists of Demonstration if any, presentation and oral examinations based on the project report.

EEU809 SELF STUDY-IV

Teaching Scheme : 00 P Total: 00 **Credit: 02**
Evaluation Scheme : 25 TA **Total Marks: 25**

1] Self study - IV is based on one class test each on the basis of 20% curriculum of the courses EEU801,EEU802,EEU803 & EEU 804 declared by respective course coordinator at the beginning of the semester

2] One faculty member shall be appointed as course coordinator for Self Study – IV and his/ her work load shall be considered as 1 hr/week.