EE 010 801: Power System Analysis

Teaching scheme **Credits: 4**
2 hours lecture and 2 hour tutorial per week

Objectives

- *To develop understanding about the techniques for analysing power systems*

Module I (15 Hours)

Power System Representation: Single phase solution of balanced three phase networks – single line diagram – impedance diagram – per unit system – transformer model – synchronous machine representation – representation of loads
Load flow studies: Network model formulation – formation of Y Bus by singular transformation – Load flow problem – Gauss Siedel Method – Newton Raphson method – Decoupled load flow methods – control of voltage profile by generators and transformers

Module II (11 Hours)

Economic Load Dispatch: System constraints – Economic dispatch neglecting losses – optimal load dispatch including transmission losses – physical interpretation of co ordination equations – exact transmission loss formulae – modified co ordination equation – automatic load dispatching – unit commitment.

Module III (10 Hours)

Automatic generation and voltage control: Single area Load frequency control – model of speed governing system – turbine model – generator model – load model – block diagram of load frequency control – steady state analysis – dynamic response – proportional plus integral control – two area load frequency control – area control error – automatic voltage control – load frequency control with generation rate constraints – speed governor dead band and its effect on automatic generation control.

Module IV (12 Hours)

Short circuit analysis: Transient on a transmission line – short circuit of a synchronous machines without and with load – selection of circuit breakers – algorithm for short circuit studies – Z Bus formulation – symmetrical components – phase shift in star delta transformers – sequence impedances of transmission lines, transformers and synchronous machines – sequence networks of a power system
Unsymmetrical faults – analysis of single line to ground, line to line and double line to ground faults in power system – analysis of unsymmetrical fault using Z bus.

Module V (12 Hours)

Stability: Dynamics of synchronous machine – power angle equation – node elimination technique – steady state stability – transient stability – equal area criterion – numerical solution of swing equation – multi machines stability – factors affecting transient stability

Text Books

1. Modern Power system Analysis: D P Kothari and I J Nagrath, Tata McGraw Hill
2. Electrical Power Systems: C. L. Wadhwa, New Age Int'l

Reference Books

1. Advanced Power System Analysis and Dynamics – L P Singh – New Age Intl.
2. Computer Techniques in Power System Analysis – M A Pai – Tata McGraw Hill
3. Power System Operation and Control: S Sivanagaraju, G Sreenivasan, Pearson Ed.
4. Power System Analysis: Bergen, Pearson Ed.
5. Power System Analysis: William D Stevenson Jr, John J Grainger, Tata McGraw Hill
6. Power System Analysis: Hadi Saadat, Tata McGraw Hill

EE 010 802: Switchgear and Protection

Teaching scheme **Credits: 4**

2 hours lecture and 2 hours Tutorial per week

Objectives

- *To develop the understanding of protection in power systems.*

Module I (12 hours)

Switch Gear: Definition And Terminology, Protective Gear and Control Gear, Basics of Switch Gear-Contactors, Isolators, Fuses, Earthling switches and Circuit Breakers

Circuit Breakers: Insulating fluid ,Properties of insulating and arc quenching medium ,initiation of arc in circuit breakers, arc interruption , current chopping and resistance switching, capacitive current breaking, restriking and recovery voltage, main parts of a circuit breaker, Rating of alternating current circuit breakers, DC circuit breakers. Bulk oil circuit breakers – Minimum Oil circuit breakers -Vacuum circuit breakers- SF6 Gas circuit breakers constructional details, principle of operation advantages and disadvantages

Module II (12 hours)

Structure of a power system, protective zone, primary and back up protection, basic requirements, protective schemes. Classification of protective relays –Induction relays – operating principle- constructional details and characteristics, thermal relays, transducer relays, electronic relays, classification based on function.

Protective schemes-over current relaying, instantaneous over current relays, time delayed relays ,definite time over current relays ,inverse time over current relays, IDMT relays and relay coordination .Differential relays circulating current differential relays and voltage balance differential relays, Biased percentage differential relays. Directional over current and directional power relays. Distance relays –Impedance relays –reactance relays and mho type relays- theory and applications.

Module III (12 hours)

Static relays –static relay components-static over current relays -static distance relays,-static differential relays – static earth fault relays-static polyphase relays

Microprocessor based relays- over current, earth fault, impedance, reactance and Mho relay-Application of microprocessor based relays. Relay testing

Module IV (12 hours)

Generator protection – faults in generators –stator protection –rotor protection –miscellaneous protections .Conventional protection of generators. Motor Protection –stator protection- rotor protection – overload protection –unbalance and single phasing protection-under voltage and reverse phase protection-protection for loss of synchronism

Transformer protection-Faults in transformers-differential protection –over current and earth fault protection –Bucholz relay. Protection of feeders - Radial feeders-parallel feeders - ring mains-differential pilot protection –Merz price protection –Translay system. Protection of transmission lines-definite time and time –distance protection-phase and earth fault protection-carrier current protection

Module V (12 hours)

Over voltages in power systems –Power frequency over voltages-Switching over voltages causes of over voltages

Protection against over voltages- surge arrestors .Wave propagation in Transmission lines and cables- transmitted and reflected waves-surge impedance. Insulation coordination

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Text Books

1. Switch Gear and Power system Protection :Ravindra P Singh, Tata Mc Graw Hill
2. Switch Gear and Power System Protection : Badri Ram D N Viswakarma, Tata Mc Graw Hill

Reference Books

1. Power System Protection and Switchgear: Ravindranath and Chander, New Age Int'l
2. Electrical Power Systems: C. L. Wadhwa, New Age Int'l
3. A Course in Electrical Power Systems: Sony, Gupta, Bhatnagar
4. Elements of Power System Analysis: William D. Stevenson, Tata Mc Graw Hill
5. Traveling Waves on Transmission Systems: Bewsley L. V.
6. Power System Protection: M. A Date, B. Oza and N.C Nair, Bharati Prakashan New Age International

EE 010 803: Electrical System Design

Teaching scheme **Credits: 4**

3 hours Lecture and 2 hours Tutorial per week

Objectives

- *Design of Electrical machines and transformers for the given specifications*
- *To impart sound knowledge in the design and estimation of electrical installations.*

Module I (18 Hours)

Design of D.C Machines:

Magnetic system- Carter's coefficient – real and apparent flux density. Design specifications – output equation – output Coefficient – specific loadings – choice of speed and number of poles – calculation of D and L – Armature design – choice of type of winding – number of slots –number of conductors per slot – current density – cross sectional area – slot insulation – length of air gap – field winding design – field ampere turns – excitation voltage per coil – conductor cross section – height of pole.

Module II (16 Hours)

Transformers: Design – single phase and three phase – output equation – specific magnetic loading – core design – single, stepped core - windings – number of turns – current density – area of cross section of conductors – types of coils – insulation – window area – window space factor – overall dimensions-heating, cooling and temperature rise calculation – continuous, short time and intermittent rating– design of cooling tank with tubes – design of small transformers like 230V/6-0-6V.

Module III (11 Hours)

Design of Synchronous Machines: Specific loading – output equation – output coefficient – main dimensions – types of winding – design of field system – turbo alternator – main dimensions – stator design – rotor design – damper winding design – comparison of water wheel and turbo alternators.

Design of three phase Induction motors: output equation – output coefficient –main dimensions – rotor bar currents.

Module IV (15 Hours)

General awareness on standards of Bureau of Indian Standards (BIS) with special reference to (1) Code of Practice for Medium Voltage Installations I.S .732, (2) Code of Practice for Earthing I.S.3043, National Electrical Code, Bureau of Energy Efficiency (BEE) and its labelling. Electrical wiring layout of a small residential building and preparation of schedule of quantity of materials, Preparation of basic electrical schemes and layout drawings of a high-rise building , Commercial building with rising main distribution to upper floors, Basic design and layout of cinema theatres, Basic illumination design of a small seminar hall with fluorescent lamps

Module V (15 Hours)

Selection of transformer and standby generator for High Tension consumers having one large capacity motor and many small motors. Basic design and preparation of single line diagram and layout drawings of an HT industrial consumer with a) outdoor and b) indoor 11kV substation. Layout and estimation of over head and under ground power distribution system. Design of earthing system for an HT consumer, Dimensions and drawings of typical earth electrodes (1)Pipe Earthing, (2)Plate Earthing. Touch, Step and Transfer potentials at EHT Sub-Stations, Earth-mat, installations of special equipment like X-Ray, Neon-Sign.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Text Books

1. Electrical Machine Design- A. K. Sawhney & A. Chakrabarthi.Dhanapat Rai &Sons
2. Electrical Design Estimating and costing.- Raina & Bhatacharya, Wiley Eastern Limited, New Delhi,
3. Electrical system Design: M K Giridharan ,I K International Publishing House Pvt.Ltd, Bangalore.

Reference Books

1.Design &Testing of electrical machines: Deshpande, Wheeler Publishing
2.Design of Electrical Machines: V N Mittle

Note: Relevant codes/ Data Sheets may be permitted for examinations

EE 010 804 L01 : ADVANCED POWER SYSTEM

Teaching Scheme **Credits:4**

2 hours lecture & 2 hours tutorial per week

Objectives

* To introduce a number of engineering and economic matters involved in planning, operating and controlling power generation and transmission systems in electric utilities.
* To introduce students to the important "terminal" characteristics for thermal and hydro electric power generation systems.

Module 1 (12 Hours)

Load frequency control-Necessity of maintaining frequency constant- Basic Generator control Loops-Load Frequency Control (Single Area Case)-Turbine Speed Governing System-Model of Speed Governing System-Turbine Model-Generator-Load Model-Block Diagram model of LFC-Steady State Analysis-Dynamic Response-Control Area Concept-Proportional Plus Integral Control-Two area Load Frequency Control-ACE

Module 2 (10 Hours)

Unit Commitment- Constraints in Unit Commitment- Spinning Reserve-Thermal Unit Constraints- Other Constraints- Unit Commitment Solution Methods-Priority List Methods-Dynamic Programming Solution.

Module 3 (14 Hours)

Hydrothermal Coordination-Long Range and Short Range Hydro-Scheduling-Hydro-Electric Plant Models-Scheduling Problems-Scheduling Energy-The short-term Hydro-thermal Scheduling Problem-Short Term Hydro-Scheduling: A Gradient Approach-Hydro –units in series-Pumped Storage Hydro plants- Pumped Storage Hydro-Scheduling by λ-γ iteration and gradient method-Dynamic Programming solution to the Hydrothermal scheduling Problem-Dynamic –Programming solution to Multiple Hydroplant problem.

Module 4 (12 Hours)

Interchange of Power and Energy-Advantages of interconnected system-Economy interchange between interconnected utilities-Inter utility-Economy Energy Evaluation-Interchange Evaluation with Unit Commitment-Multiple-Utility Interchange Transactions-Wheeling-Other Types of Interchange-Power Pools-The Energy –Broker System-Centralized Economic Dispatch of a Power Pool-Allocating Pool savings

Module 5 (12 Hours)

Power system Security-Functions of System Security-SCADA-Factors affecting Power System Security-Contingency Analysis: Detection of Network Problems-An overview of Security

Analysis-Linear Sensitivity Factors-Calculation of Network Sensitivity Factors-AC Power Flow Methods-Contingency Solution-Concentric Relaxation-Bounding

Text Books

1. Power Generation Operation and Control –Allen J Wood & Bruce F Wollenberg

2. Power System Engineering –I.J.Nagrath &D.P.Kothari

Reference Books

1. Power System Analysis –Arthur R Bergen &Vijay Vittal

2. Elements of Power System Analysis- William D Stevenson

3. Power System Operation and Control- S.Sivanagaraju & G.Sreenivasan

EE 010 804 L02: COMPUTER NETWORKS

Teaching Scheme

2 hours lecture and 2 hours tutorial per week **Credits-4**

Objectives:

- *To provide knowledge in the specific area of computer networking and the Internet.*
- *To expose students to technological advances in computer communications.*

Module 1 (12 Hours)

Introduction: Goals and applications of networks - Network Topologies: Broadcast - Point to point - bus, star, ring, tree - Types of network : LAN, MAN, WAN -OSI reference model - TCP/IP reference model - Client server computing. **Physical layer** - Transmission media: Guided media – wireless. Packet switching – telephone and cable network in data transfer(basic concepts) : dial-up connection – DSL- cable TV data transfer.

Module 2 (12 Hours)

Data link layer: Services - Data framing - Error handling – Detection and correction codes: Parity check, Hamming code, CRC, Checksum -Data link protocols: Stop and wait protocol, Sliding window protocol(basic concepts only) - data link layer in the Internet- SL1P/PPP.

Module 3 (12 Hours)

Medium access sub layer: Channel allocation - static vs dynamic channel allocation - CSMA protocol - collision detection - wireless LANs – collision avoidance- IEEE 802 standards - Ethernet - Token bus -Token ring – wireless

Module 4 (14 Hours)

Network layer: services - Routing - congestion control - internetworking - Principles - Gateways - Host - backbone network - Network layer in the Internet - IP protocol - IP address - Internet control protocols.
Transport layer: Services - Internet Transport protocols - TCP and UDP.

Module 5 (10 Hours)

Application layer: Services - Network security - Cryptography - DNS - Name servers -. Internet services: E-mail - FTP -TELNET - WWW - Network Management concepts.

Text Books:

1. Computer Networks - Tanenbaum, Pearson Education Asia
2. Data communication and networking – Forouzan, Tata McGraw Hill

References:

1. Data and computer communications - William Stalling, Pearson Education Asia
2. Data Communication, Computer networks - F. Halsall, Addison Wesley and open systems
3. Computer Networks, A system approach - Peterson & Davie, Harcourt Asia
4. The Internet Book- Douglas E. Comer, Pearson Education Asia
5. Internet Complete Reference - Harley Harn Osborne

EE 010 804 L03: Generalized Machine Theory

Teaching Scheme
2 hours lecture & 2 hours tutorial per week **Credits:4**

Objective

To provide the basic ideas of mathematical modelling and analysis of electric machines

Module I (12 Hours)
Introduction
Unified approach to the analysis of Electrical Machines-Basic two pole model of rotating machines-Kron's primitive machine-voltage, power and torque equation-Linear transformation from 3-phase to 2-phase and from rotating axes to stationary axes-invariance of power

Module II (10 Hours)
DC Machines
Application of generalized theory to separately excited, shunt, series and compound machines-steady state and transient analysis-sudden short circuit of separately excited generator

Module III (14 Hours)
Poly-phase Synchronous Machines
Generalized machine equations-steady state analysis of salient pole and non-salient pole machines-phasor diagrams-power angle characteristics-reactive power-short circuit ratio transient analysis -sudden three phase short circuit at generator terminals-reactance-time constants-transient power angle characteristics damping and synchronizing torques in small oscillation stability analysis - application of small oscillation models in power system dynamics.

Module IV (14 Hours)
Induction Machines
Representation of Induction machine using
Generalized machine theory - Formation of general equations - three phase induction motor - equivalent two phase machine by m.m.f equivalence-voltage equation-steady state analysis-equivalent circuits-torque slip characteristics-effect of voltage and frequency variations-electric transients in induction machines-speed control of induction motor-introduction to vector control-applications in speed control of induction machine

Module V (10 Hours)
Representation of single phase Induction motor using Generalized machine theory - Formation of general equations,-voltage and torque equation-steady state analysis

Text Book

Generalised Machine Theory: P S Bimbhra

EE 010 804 L04: FEM Applications in Electrical Engineering

Teaching scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of numerical methods applied for analysis of electromagnetic fields*
- *To develop understanding about Finite element analysisand its applications for electrical machine analysis.*

Pre-requisites

- EE 010 404 Electromagnetic Filed Theory
- EE 010 702 Synchronous Machines

Module 1 (12 Hours)

Electromagnetic fields-General Overview-Maxwell's equation-constitutive relationships and continuity equations-Laplace, Poisson and Helmholtz equation-Overview of computational methods in electrostatics

Module 2 (12 Hours)

Basic principles of Finite element method- Introduction-Classical Methods for field problem solutions-The classical residual method (Galerkin's method)-The classical Rayleigh-Ritz's method– The finite element method-Partition of the domain-Choice of the interpolating function-formulation of the system-solution of the problem.

Module 3 (10 Hours)

Analysis of 2D fields using FE method-.Reduction of field problem to a 2D problem-Boundary conditions-Dirichlet's ,Neumann's and periodic conditions-Discretization-Assembly.

Module 4 (12 Hours)

FE Analysis of Electromagnetic devices: Equivalent electric circuit of single phase transformer-computation of no load inductance –computation of magnetic flux density-main flux-flux linkage-magnetic energy-self and mutual inductance-Estimation of iron losses.

Module 5 (14 Hours)

FE analysis of rotating electrical machines: synchronous generator-computation of no load characteristics –computation of Ld, Lq -saturation effect-computation of machine characteristics 3phase induction motors: Equivalent circuit-no load and blocked rotor test of motor -motor analysis using FEA under load-Non linearity of magnetic materials-computation of torque.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

Text Book:

1. Electrical Machine Analysis using finite elements-Nicolas Bianchi-CRC Press.
2. Numerical Methods in Electromagnetism:M.V.T .Chari, S.J.Salon-Academic Press

References:

1. The performance and Design of AC Machines: M.G. Say, Cbs Publishers
2. Theory of Alternating Current Machinery: Alexander Langsdorf, Tata Mgraw Hill
3. A course in Electrical Engg. Vol.2: C.L Dawes, McGraw- Hill Book Company inc.
4. Electromagnetics- John D Krauss McGrow Hill International
5. Finite elements analysis of Electrical Machines-Sheppard J.Salon - Khuwer International Series
6. Introduction to FE method-Erik G Thomson-Wiley India(P) Ltd
7. Finite element analysis-George R Buchanan-Schaum's Series- McGrow Hill Companies

EE 010 804 L05: Digital Signal Processors

Teaching Schedule:
2 hour Lecturer and 2hour Tutorial / week **Credits-4**

***Objectives* :**
To introduce the students to various techniques of digital signal processing and the basic architecture of digital signal processors

Module I (12 Hours)
Fundamentals of Programmable DSPs
Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes in P-DSPs, On-chip Peripherals, Computational accuracy in DSP processor

Module II (12 Hours)
ADSP Processors

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors

Module III (12 Hours)
TMS320C5X Processor
Architecture, Assembly language syntax, Addressing modes, Assembly language instructions, Pipeline structure, Operation Block Diagram of DSP starter kit, Application Programs for processing real time signals.

Module IV (12 Hours)
Programmable Digital Signal Processors

Data Addressing modes of TMS320C54XX DSPs, Data Addressing Modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, On-chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XX Processors.

Module V (12 Hours)
Advanced Processors
Code Composer studio, Architecture of TMS320C6X, Architecture of Motorola DSP563XX, Comparison of the features of DSP family processors.

Text Book

1. Digital Signal Processors, Architecture, Programming (*B. Venkata Ramani and M. Bhaskar*) TMH 2004.

Reference Books

1. DSP Implementation using DSP microprocessor with Examples from TMS32C54XX (*Avtar Singh, S. Srinivasan*) Thamson2004
2. Digital signal Processing A Practical approach (*E.C. Ifeachor and B. W. Jervis*) Pearson Publication
3. Digital signal Processing (*Salivahanan Ganapriya*) TMH, second Edition
4. DSP Processor Fundamentals. Architecture and Features (*Lapsleyetal*) S. Chand & co. 2000.
5. Digital signal Processing (*Jonathen Stein*) John Wiley 2005
6. Digital signal Processing (*S. K. Mitra*) Tata McGraw-Hill Publication, 2001.

Mahatma Gandhi University

EE 010 804 L06: Optoelectronics

Teaching Schedule:
2 hour Lecturer and 2hour Tutorial **Credits-4**

Course Objectives :

Optical fibres have become an enabling technology in the information system.
This course gives basic ideas of design, operation & capabilities of fibre system.
Also new technological advances in fibre optic communication are discussed.

Module I (12 Hours)
Optical fibre wave guides-Review of ray theory-Electromagnetic mode theory-Phase and group velocity-Modes-guided, radiative and leaky modes-'V' number-cut off wave length-Step index and graded index fibres-Parameters of optical fibre-problems.
Signal degradation in fibres-Attenuation-Absorption loss-Linear and nonlinear scattering loss-Fibre bend loss-Dispersion mechanisms-Intramodal and intermodal dispersion-Expressions-modal noise-overall dispersion in single mode/multimode fibres-problems-mode coupling.

Module II (14 Hours)
Optical sources-Light emitting diodes- P N junction characteristics- Direct and Indirect band gap materials- Spontaneous emission- Carrier concentration variation in n+p junction- carrier life time-Diffusion coefficient- Diffusion length- Injection efficiency- internal Quantum efficiency-Power internally generated- Overall efficiency of LED- problems- Heterojunction LEDs – Advantages- LED modulation- Electrical and Optical Bandwidth- LED structures-ELEDs and SLEDs-LED characteristics-Effect of temperature- LED Drive Circuits.

LASER diodes- Spontaneous Vs Stimulated emission-Einstein's relation-population inversion-cavity resonance and threshold gain-Laser modes-stimulated emission in PN junction-Rate equation-condition for lasing-Laser diode characteristics-Modulation-frequency chirp-Heterojunction LASER-LASER structures-LED Vs LASER diodes.

Module III (12 Hours)
Optical Detectors and Fibre optic link- Requirements for Detectors-Intrinsic and extrinsic absorption responsivity-cut off wave length-Quantum efficiency- classification of detectors-Photodiodes-PN junction photo diode-PIN photodiode- response and noise- APDs –Advantages of APD- APD Bandwidth and noise-Phototransistor-parameters of phototransistor-problems-Detector performance parameters-noises-NEP

Power launching and coupling- source to fibre coupling-joints- fibre to detector coupling- losses-fibre splicers, connectors and couplers-types-Fibre optic link-System considerations-link power budget-rise time budget-Link Design

Module IV (10 Hours)
Fibre optic receivers-Block schematic- Data patterns-noice in receivers-Speckle noise-Reflection noise-Receiver Circuit –pre amplifier-high impedance and transimpedance amplifier-equalization and sensitivity.

Regeneration- inter symbol interference- Filter characteristics- Eye diagram- Effect of amplifier and thermal noise- noise penalty in a practical system.

Module V (12 Hours)

Advanced system technology-Optical amplifiers-Raman and Erbium doped optical amplifiers-noises-Wave length Division Multiplexing(WDM) and components-Optical network-wave length routed networks.

Fibre optic sensors-classification-Fibre bragg gratings for strain and temperature sensors-displacement sensor-optical computing concepts-optical logic gates.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Text Books

1. Optical communication Systems-John Gower-PHI
2. Optical fibre Communication Systems-Principles and practice-John M. senior-Pearson
3. Optoelectronics devices and system-Dr. S. C. Gupta-PHI

Reference Books

1. Optical fibre Communication-Keiser Gerd, Mc Graw Hill
2. Fibre optic communication system-Agarwal G. P., John Wiley & Sons
3. Fibre optic communications-Harold Kolimbiris-Pearson
4. Fibre optic communications-Joseph C. Palais-Pearson
5. Fibre optic communication – M. Nagabushaan, L. Satishkumar-Denett & Co.

EE 010 805 G01: Soft Computing Techniques
(Global Elective)

Teaching scheme **Credits: 4**
3 hours lecture and 1 hour tutorial per week

Objectives

- *To introduce the ideas of neural network, fuzzy logic,genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.*
- *To introduce the techniques of soft computing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.*

Module I (12 Hours)
Fundamentals of ANN – Biological prototype – Neural Network Concepts, Definitions - Activation. Functions – single layer and multilayer networks. Training ANNs – Supervised and unsupervised network.
Perceptrons – Exclusive OR problem – Linear seperability – perceptron learning - perceptron training algorithms.The back propagation Neural network – Architecture of the back propagation Network – Training algorithm –Network paralysis _ Local minima – temporal instability.

Module II (12 Hours)
Unsupervised learning-Competitive Network-Winner take all policy .Network initialization and weight adjustment.Geometric interpretation. Associative memory -ART NETWORKS – Bidirectional Associative memories- retreiving stored information.
Neuro Control System-Classical controls-neuro control –Basic identification scheme using nn-Forward modelling: Series -parallel identification.Non linear system identification-Direct inverse neuro control scheme with ANNI and ANNC.Adaptive neuro control.

Module III (12 Hours)
Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Module IV (12 Hours)
Introduction to Genetic Algorithm. Simple Genetic Algorithm and its major operators: Reproduction, Crossover, Mutation etc. Mathematical Construction of Genetic Operators. Tunning of membership function using genetic algorithm.

Module V (12 Hours)
Application of neural network for load forcasting, image enhancement, signal processing, pattern recognition.
Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.
Application of GA to neural network Tuning of controllers, Electric drives and Power System.
Introduction to MATLAB Neural network tool box, Fuzzy tool box and Genetic programming (Basic Treatment Only)

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) , One assignment must be based on MATLAB Programming for any application of neural network, Fuzzy and GA tool.(Only Basic Treatment expected)
20% - Regularity in the class

Text Books

1. Philip D.Wasserman, *Neural Computing(Theory and Practice*)
2. J.Zuradha,Introduction to Artificial Neural System
3. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic algorithms, PHI, 2003.
4. *Kalyanmoyi Deb,Multi-Objective Optimization using Evolutionary Algorithms,Wiley,2001*

Reference Books

1. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", McGraw-Hill Inc. 1997
2. Linus Fe, *Neural Network in Computer Intelligence* , McGrawHill
3. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2007.
4. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2001.
5. T.Mitchel, Machine Learning,McGrawHill, 1997.
6. **Reeves**, Colin R., **Rowe**, Jonathan E.Genetic Algorithms - Principles and Perspectives,Springer,2002

EE 010 805 G02: Intellectual Property Rights

(Global Elective)

Teaching scheme **Credits:4**

2 hour lecture and 2 hour tutorial

Objectives

1. *To appreciate the concept of Intellectual Property and recognize different kinds of Intellectual Property*
2. *To appreciate the rationale behind IP and underlying premises*
3. *To know the position of IP under the constitution of India*

Module 1(12 Hours)

Concept of intellectual property – different types of IP-Rationale behind Intellectual property-Balancing the rights of the owner of the IP and the society – Enforcement of IPRs – IP and constitution of India.

Module 2 (12 Hours)

World intellectual Property Organization (WIPO) – WTO/TRIPS Agreement – India and the TRIPS Agreement – Patent law in India –Interpretation and implementations – Transitional period.

Module 3 (12 Hours)

Patent system – Patentable Invention – Procedure for obtaining patent – Rights of a patentee – Limitations on Particular's Rights – Revocation of patent for Non – working Transfer of patent – Infringement of patent.

Module 4 (12 Hours)

Indian Designs Law – Meaning of Design Registration and Prohibitions – Copyright in Designs – Piraiy of Design and Penalities – Steps for foling an Application – Copyright law in India –Owner of the copyright – Rights of Broad Casters and Performers – Registration of Copyright – Assignment, Licensing and Transmission – Infringement – International Copyright and Copyright Societies

Module 5 (12 Hours)

Trade Mark Law in India – Functions of a Trade Mark – Registration of Trade Mark Exploiting Trade Mark – Infringement –Offenses and Penalties – Indian Trade Mark Act 1999; salient features. Geographical Indications – Registration of Geographical Indication – Term and Implication of Registration – Reciprocity and Prohibition on Registration.

Text books

1. Jayasree Watal **-Intellectual Property Rights:** In the WTO and Developing Countries -Oxford University Press
2. V.Sarkar-Intellectual Property Rights and Copyright- ESS publications

References

1. R..Anita Rao and Bhanoji Rao - Intellectual Property Rights –Eastern Book Company

2. Arthur R Miller and Michael H Davis – Intellectual Property in a Nutshell: marks patents, Trade and Copy Right

3. Richard Stim - Intellectual Property marks patents, Trade and Copy Right – Cangage Learning
4. Christopher May and Susan K Sell - Intellectual Property Rights –A critical History - Viva Books

Mahatma Gandhi University

EE 010 805 G03 Advanced Mathematics

(Global Elective)

Teaching Schedule: **Credits: 4**

2 hour Lecturer and 2 hour Tutorial/week

Module 1 (12 Hours)
Green's Function
Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential operator – Green's function – initial value problems – boundary value problems – simple cases only

Module 2 (12 Hours)
Integral Equations
Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green's function – solution of Fredhlom integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

Module 3 (12 Hours)
Gamma, Beta functions
Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

Module 4 (12 Hours)
Power Series solution of differential equation
The power series method – Legendre's Equation – Legendre's polynomial – Rodrigues formula – generating function – Bessel's equation – Bessel's function of the first kind – Orthogonality of Legendre's Polynomials and Bessel's functions.

Module 5 (12 Hours)
Numerical solution of partial differential equations
Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson's equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

Text Book.

S.S Sasthri, "Introductory methods of Numerical Analysis",Prentice Hall of India.

References

1. Ram P.Kanwal, Linear Integral Equation, Academic Press, New York.
2. Allen C.Pipkin, Springer, A Course on Integral Equations, Verlag.
3. H.K.Dass, Advanced Engg. Mathematics, S.Chand.

4. Michael D.Greenberge, Advanced Engg. Mathematics, Pearson Edn. Asia.
5. B.S.Grewal, Numrical methods in Engg.&science, Khanna Publishers.
6. R.F. Hoskins, Generalized functions, John Wiley and Sons.
7. Bernard Friedman, Principles and Techniques of Applied Mathematics, John Wiley and sons
8. James P.Keener, Principles of Applied Mathematics, Addison Wesley.
9. P.Kandasamy, K.Thilagavathy, K.Gunavathy Numerical methods, S.Chand & c

EE 010 805 G04 Virtual Instrumentation
(Global Elective)

Teaching scheme **Credits: 4**
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Graphical coding using LabVIEW*
- *To develop understanding about graphical programing and dynamic system control using tool boxes of LabVIEW.*

Pre-requisites: *Knowledge required to study this subject (especially any subject previously studied)*

Module I (12 Hours)
Basic concept of Virtual instrumentation - Hardware and Software in Virtual Instrumentation. Virtual instrumentation model.
Introduction to LabVIEW software – Conventional and Graphical Programming- Advantages - Tool boxes- Front panel, Block diagram and Icon – Functions Palette - Controls and Indicators – Data flow programming- G code.

Module II (12 Hours)
LabVIEW programming – Front panel and Block diagram -VIs and Sub Vis – Express VI - Different data types . Structures in LabVIEW- For loop, While loop, Shift registers, tunnels and feedback nodes. Timing inside loops- Communication between loops - local and Global variables.
Arrays – Two dimensional and three dimensional arrays – Auto indexing- Matrix operations with arrays- Polymorphism. Clusters – Order of cluster elements- Assembling and disassembling of clusters. Conversion between clusters and arrays - error handling. Formula nodes and Mathscript

Module III (14 Hours)
MAX software - Data Acquisition using LabVIEW – Specifications of DAQ system- Classification of signals- Signal conditioning- SCXI- Grounded and floating signal sources. Measuring systems- Differential Measurement system – Referenced single ended (RSE) system – Non referenced single ended (NRSE) system – sampling of signals.
NI-DAQmx - Scales- Tasks. Reading and writing of Digital / Analog signals. Multi channel acquisition – counting frequency and events. Examples for AC/DC voltage, current, Power measurement.

Module IV (12 Hours)
Instrument control using LabVIEW - VISA – VISA functions. State machines - Property nodes of Control / indicators – Event structures. RS 232C / RS 485 interfacing- Parallel port interfacing.
String controls and indicators- string functions – converting string value to numbers- Writing to / reading from spreadsheet files.

Module V (10 Hours)
Advanced features of LabVIEW – Notifiers- Semaphore – Queue – Rendezvous- occurance. Data sockets – Shared Variables-Report generation.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software

Text Books

1) LabVIEW for every one – Jeffrey Travis, Jim Kring, Pearson Education
2) Virtual Instrumentation using LabVIEW – Jovitha Jerome, PHI Learning
3) Virtual Instrumentation using LabVIEW – Sanjay Gupta & Joseph John, Mc Graw Hill Publication

EE 010 805 G05: Digital Image Processing

(Global Elective)

Teaching scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objectives

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques and image restoration procedures.
- To study the image segmentation and representation techniques.

Module I (14 hours)

Digital image representation : Elements of digital image processing systems - Image digitizers & scanners - Elements of visual perception - Brightness & contrast - colour perception & processing - pixel based transformation – geometric transformation – image file formats

Image sampling & Quantization - Two dimensional Sampling theorem - Reconstruction of image from its samples – Aliasing

Module II (14 hours)

Image Transforms : Two dimensional DFT & its properties - Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar, Slant, and Karhunen – Loeve transforms

Module III (10 hours)

Image Enhancement : Point processing - Histogram processing - Spatial Filtering – image subtraction - image averaging - Enhancement in the frequency domain - colour Image processing.

Module IV (12 hours)

Image Restoration : Degradation model – Diagonalization of circulant matrices - Inverse filtering - Wiener filter methods – Constrained least mean square filtering

Image Coding & Compression- basic principles Image compression: Run length coding , predictive coding ,Basics of Image compression standards:

Module V (10 hours)

Image analysis : Segmentation – Thresholding – point, line and edge detection – Boundary detection - Region Based segmentation - image reconstruction – radon transform – projection theorem – convolution filter back projection - Fourier reconstruction method – applications of image processing.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Text Books

1. Rafael C. Gonzalez - Richard E. Woods, *Digital Image Processing*, Pearson Education
2. Dutta Majumdar - *Digital Image Processing and Applications,* PHI

Reference Books

1. Madhuri A. Joshi – Digital Image Processing,PHI, New Delhi,2010
2. Anil K. Jain - Fundamentals of Digital Image processing," Prentice Hall India, 1989.
3. William K. Pratt - Digital Image Processing, John Wiley and sons, New delhi, 2010.
4. S.Jayaraman, S. Esakkiarajan. T. Veerakumar- Digital Image Processing,TMH,New Delhi, 2010.
5. Rosenfield and A. C. Kak - Digital Picture Processing, 2nd edition, Vols. 1 & 2, Academic Press, New York, 1982.
6. R. J. Schalkoff - Digital Image Processing and Computer Vision, John Wiley & Sons,

EE 010 805 G06: Distributed Power Systems

Teaching scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart introductory knowledge of distributed power systems*
- *To develop understanding of power generation systems using renewable energy*
- *To develop understanding of integrating the renewable energy systems to the grid.*

MODULE I (12 Hours)

Photo-voltaic and Fuel cells: Basic characteristics of sunlight – solar energy resource – photovoltaic cell – cell efficiency – characteristics – equivalent circuit – photo voltaic for battery charging – charge regulators – PV modules – battery backup – limitations – equipments and systems – types of fuel cells – losses in fuel cells.

MODULE II (12 Hours)

Wind Turbines and Embedded generation: Wind Source – wind statistics – energy in the wind – aerodynamics – rotor types – forces developed by blades – aerodynamic models – braking systems – tower – control and monitoring system – power performance – Wind driven induction generators – power circle diagram – steady state performance – modeling – integration issues – impact on central generation – transmission and distribution systems – wind farm electrical design.

MODULE III (12 Hours)

Isolated generation: Wind – diesel systems – fuel savings – permanent magnet alternators – modeling – steady state equivalent circuit – self excited induction generators – integrated wind – solar systems.

MODULE IV (12 Hours)

Other Renewable Sources and Bio fuels: Micro- hydel electric systems – power potential – scheme layout – generation efficiency and turbine part flow isolated and parallel operation of generators – geothermal – tidal and OTEC systems – classification of bio fuels – Conversion process – applications.

MODULE V (12 Hours)

Power Quality Issues: sustained interruptions – voltage regulation – harmonics – voltage sag
Operating conflicts: Fault clearing requirements – reclosing – interference with relaying – voltage regulation issues – islanding – ferroresonance.
Distributed generators on low voltage networks: Network operation – interconnection issues – integrating techniques

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
20% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

Text Books

1. John F.Walker & Jenkins ,N., ` Wind Energy Technology', John Wiley and sons, Chichester, U.K.,1997.
2. Sukhatme,S.P.,`Solar Energy- Principles of Thermal Collection and Storage' Tata Mc-Graw-Hill, New Delhi.
3. S.L.Soo, 'Direct Energy Conversion', Prentice Hall Publication.
4. Roger.C.Dugan, Mark F McGranaghan, Surya Santoso, H.Wayne Beaty Electrical Power Systems Quality, Tata McGraw Hill

Reference Books

1. Freries L.L., 'Wind Energy Conversion Systems', Prentice Hall U .K., 1990.
2. Kreith,F., and Kreider,J.F., 'Principles of Solar engineering', Mc-Graw-Hill, Book Co.
3. Imamura M. S.et.al., 'Photo voltaic System Technology, European Hand Book',H S., Stephen and Associate, 1992.
4. James Larminie, Andrew Dicks,Fuel Cell Systems', John Wiley and Sons Ltd .

EE 010 806: Electrical Machines Lab II

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To conduct various tests on synchronous and induction machines and to study their performance.*

1. Alternator regulation by direct loading.
2. Alternator regulation by emf/mmf methods.
3. Alternator regulation by potier method.
4. Regulation of salient pole alternator – slip test.
5. Alternator V curves for constant input/output.
6. Synchronization of alternator to mains.
7. Study of induction motor starters and brake test on three phase induction motor.
8. Variation of starting torque with rotor resistance in slip ring induction motor.
9. Predetermination of performance characteristics of induction motor – circle diagram and equivalent circuit.
10. Performance characteristics of pole changing induction motor.
11. Hysteresis loss calculation of induction machine.
12. Single-phasing of three phase induction motor - torque slip characteristics.
13. Induction generator characteristics
14. Performance characteristics of single phase induction motor.
15. Speed control of three phase induction motor using power electronic converters - V/f control.

References

1. The performance and Design of AC Machines: M.G. Say, CBS Publishers
2. Theory and performance of Electrical Machines: J.B Gupta, S. K. Kataria & Sons
3. Theory of Alternating Current Machinery: Alexander Langsdorf, Tata Mgraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

Note: Minimum of 12 experiments should be conducted.

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

EE010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

EE010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.