EEC- 701 Power System Protection

Unit I Faults: Introduction, need for protective schemes, nature and cause of faults, types of fault, per unit representation, analysis of symmetrical fault, current limiting reactors, current transformers, potential transformers and their applications in their protection schemes.

Unit II Protective Relays :Requirement of relays, universal torque equation, non-directional and directional over current relays, earth fault relays, distance relays ,impedance, mho and reactance relays, differential relays ,negative sequence relays ,under frequency relays, static relays, microprocessor and computer based protective relaying, apparatus and line protection: alternator, transformer, bus bar and motor protection using relay, feeder protection, radial and ring main system, microprocessor based protective schemes.

Unit III Circuit Breakers: Functions of switchgear, arc extinction ,arc control devices, recovery voltage and restriking voltage, current chopping and capacitance current breaking, bulk oil, low oil, air break, air blast, and sulphur hexafluoride and vacuum circuit breakers , HVDC breakers, rating, testing of circuit breakers.

Unit IV Surge Protection: Switching surges, lightning phenomenon, traveling waves on transmission lines, over voltage due to lightning, protections against lightning, lightning arresters, lightning arrester selection ,surge absorbers.

Unit V Earthing and Insulation Co-Ordination: Solid resistance and reactance earthing, arc suppression coil, earthing transformers, earth wires, earthing of appliances, insulation coordination: determination of line insulation, insulation levels of sub-station equipment, co-ordination amongst items of substation equipment, introduction to Indian electricity rules.

References:

1. CL Wadhwa, Electrical Power systems, New age International.
2. B. Ravindran and M Chander, Power System protection and Switchgear, New Age
3. International reprint 2006.
4. Badrirka, Power System protection and switchgear, TMH
5. Haddi Saadet, Power System Analysis, TMH
6. Switchgear & protection Sunil S. Rao. Khanna Publication

List of Experiments :(Extendable)

1. Determination of drop out factor of an instantaneous over current relay.
2. Determination of operating characteristic of IDMT relay.
3. Determination of operating characteristic of differential relay.
4. Study and operation of gas actuated protective relay.
5. Study and operation of static over current relay
6. Analysis of power system faults (Symmetrical & Asymmetrical) using MATLAB.
7. Study of SF6 circuit breaker
8. Protectional simulation study of generator, Transformer, Feeder & Motor protection.

EEC- 702 Generalized Theory of Electrical Machines

Unit I Generalized Theory: Conversions, basic two pole machines, transformer with movable secondary, transformer voltage and speed voltage, Kron's primitive machine , analysis of electrical machines, voltage and torque equation.

Unit II Linear Transformations: Invariance of power, transformations from displaced brush axis, three phases to two phase, rotating axes to stationary axes, transformed impedance matrix, torque calculations.

Unit III DC Machines: Generalized representation, generator and motor operation, operation with displaced brushes, steady state and transient analysis, sudden short circuit, sudden application of inertia load ,electric braking of dc motors.

Unit IV Synchronous Machines: Generalized representation, equivalent circuit, steady state analysis, transient analysis , phasor diagrams, electromechanical transients.

Unit V Special Machines: Generalized representation, steady state analysis of reluctance motor, brushless dc motor, variable reluctance motor & single phase series motor.

References:

1. B.Adkins & R.G.Harley, The General theory of AC Machines.
2. P.S.Bhimbra, Generalised theory of Electrical m/c
3. White & Woodson, Electro Mechanical Energy Conversion.
4. D. P. Kothari,B. S. Umre, "Laboratory Manual for Electrical Machines", IK International New Delhi.

List of Experiments (Extendable):

1. To determine subtransient direct axis and quadrature axis synchronous reactances of salient pole machine.
2. To conduct Hopkinson's test on a pair of DC shunt machine.
3. Retardation test on dc shunt motor.
4. Regenerative test on dc shunt machines.
5. Brake test on three phase squirrel cage induction motor
6. To Study the Variation of Speed and Load Test on Schrage Motor
7. To determine Negative Sequence and Zero sequence Reactances of Synchronous Generator
8. Load characteristics of universal motor. Operating on DC and AC supply, comparison of performance.

EEC- 703 Computer Aided Design of Electrical machine

Unit-I Computer Aided Design Philosophy of computer aided design, advantages, limitations, analysis and synthesis methods, selection of input data and design variables, flow charts for design of induction motor and synchronous machine, optimization of design constrained and unconstrained optimization problem

Unit-II DC machine:-Design of armature windings & field systems, selection of variables for optimal design, formulation of design equations, objective function, constraint functions, algorithms for optimal design.

Unit-III Power Transformer:-Design of magnetic circuit, design of windings, selection of variables for optimal design, formulation of design equations, objective function, constraint functions, algorithms for optimal design.

Unit-IV Single Phase Induction Motor-Calculation of main dimensions of stator, complete design of stator with its punching details, design of main and auxiliary winding, design of rotor, performance calculation of designed rotor and performance by equivalent circuit approach.

Three Phase Induction Motor -Design of stator, windings design of squirrel cage rotor, design of slip ring rotor, selection of variables for optimal design, formulation of design equations, objective functions constraint functions, algorithms for optimal design.

Unit-V 3-Phase Alternator:-Design of stator, windings, design of field systems for salient pole and non-salient pole machines, selection of variables for optimal design, formulation of design equations, objective function, constraint functions, algorithms for optimal design.

References:

1. Computer- Aided Design of Electrical Equipment- by Dr. M. Ramamoorthy-Affiliated East-West press Pvt. Ltd. New Delhi.
2. Electrical Machine Design- by A.K. Sawhney, Dhanpat Rai & Sons.
3. Performance and Design of A.C. Machines-M.G. Say, Affiliated East West Press Pvt. Ltd., New Delhi.
4. Performance and Design of D.C. Machines- Clayton & Hancock.
5. Principles of Electrical Machine Design with Computer Programmes by- S.K. Sen, Oxford & IBH Publishing Co.

EEC- 703 Computer Aided Design of Electrical machine

List of Experiment (Extendable):

1. Computer Program in "C" in MATLAB for Complete Design of 500KW, 600v lab wound dc machine
2. Computer Program in "C" in MATLAB for Optimal Design of dc machine
3. Computer Program in "C" in MATLAB for Complete Design of core type power Transformer
4. Computer Program in "C" in MATLAB for Complete Design of salient pole Alternator
5. Computer Program in "C" in MATLAB for Complete Design of Synchronous Machines
6. Computer Program in "C" in MATLAB for Optimal Design of cage rotor
7. Computer Program in "C" in MATLAB for Complete Design Of single ph IM
8. Computer Program in "c" in MATLAB for Optimal Design of slip ring IM

EEC-704(A) Solar PV Application

Unit-I Solar Photovoltaic: Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters, Solar Photovoltaic Module Array Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module

Unit-II Batteries: Battery function, Types of Batteries, Battery parameters, Selection of Battery, Series Parallel combination of Batteries, Batteries for Photo voltaic System, Application of Batteries in Solar PV system, Battery Maintenance and Measurements, Battery Fault Detection and Test, Battery Installation for PV system.

Unit-III Controller: Charge Controller, MPPT and Inverter Power MOSFET and IGBT, Opto coupler, Buck and Boost Converter, Fly back Converter, Full Bridge Inverter, Voltage and Current Feedback, DC to DC power converter, DC to AC Converter, AC to DC Converter, Battery Charge controller, Maximum Power Point Tracking, Specification of Inverter and charger.

Unit-IV Design: Solar PV System Design and Integration Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant.

Unit-V Installation: Safety Installation and Trouble shooting of Standalone Solar PV System, Maintenance of Solar PV System, Safety in installation of Solar PV System.

References:

1. Chetan Singh Solanki, Solar Photovoltaic's: Fundamental Technologies and applications, 2 nd Edition, Prentice Hall India Learning Private Limited, 2011
2. H.P. Garg & Prakash, Solar Energy-Fundamentals and applications, TMH Publication, 2000
3. Tomas Markvart Solar Electricity, 2 nd Edition, John Wiley Publication, 12 May 2000
4. Michael boxwell, The Solar Electricity Handbook, Greenstream publishing, 2013

EEC-704(B) Power Quality

Unit-1: Introduction-Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

Unit-II: Non Linear Loads-Single phase / Three phase static converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

Unit-III: Analysis and Conventional Mitigation Methods-Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, instantaneous real and reactive powers, Analysis of distortion: On– line extraction of fundamental sequence components from measured samples – Harmonic indices.

Unit-IV : Voltage Sag-Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

Unit-V: Power Quality Improvement-Utility-Customer interface –Harmonic filters: passive,– Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC – control strategies: P-Q theory, Synchronous detection method – Custom power park – application of custom power devices.

References:

1. Power Quality Enhancement Using Custom Power Devices 2002 ArindamGhosh Kluwer
2. Academic Publishers
3. Electric Power Quality 1994(2nd edition) G.T.Heydt Stars in a Circle Publications
4. Power Quality Edition (Year of publication) R.C. Duggan
5. Power system harmonics A.J. Arrillga
6. Power electronic converter harmonics Derek A. Paice

EEC-704(C) Entrepreneurship Development

Unit-I : Promotion of Entrepreneurship: Meaning, definition and functions of an entrepreneur, qualities of a good entrepreneur; Role of Entrepreneur in economic development; Government measures for the promotion of small scale industries with special reference to Haryana; Cultural factors in developing entrepreneurship.

Unit -II : Ownership and Location of Industrial Units: Different forms of industrial organisation, theories of industrial location. process of preparing project reports.

Unit -III : Size of Firm and Pricing :Concept of optimum firm, factors determining optimum size, technical, managerial, marketing uncertainties and risk, pricing methods, policies and procedures.

Unit -IV : Financing of Small Industries : Importance and need : Commercial Banks and term lending in India; Banks and under-writing of capital issues; Brief description about the role of other financial agencies viz; Industrial Finance Corporation of India, State Financial Corporation, Industrial Development Bank of India; Unit Trust of India.

Unit -V : Problems Faced by Small Enterprises: Problems connected with Marketing, Management of New Products; Power; Finance; Raw Material; Under-utilization of capacity; Causes of under – utilization; Rehabilitation of Sick Mills.

References:

1. Entrepreneurship of Small Scale Industries – Deshpande Manohar D. (Asian Publishers, New Delhi)
2. Environment and Entrepreneur – Tandon B.C. (Asian Publishers, New Delhi).
3. The Industrial Economy of India – Kuchhal S.C. (Chaitanya, Allahabad).
4. Emerging Trends in Entrepreneurship Development Theories & Practices – Singh P.Narendra (International Founder, New Delhi)
5. Entrepreneur, Banker & Small Scale Industries – Bhattacharya Hrisnikes.
6. Entrepreneurship & Growth of Enterprise in Industrial Estates – Rao Gangadhara N.

EEC-705(A) Digital Signal Processing

Unit – I Discrete-Time Signals and Systems: Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete time signals and systems.

Unit – II The Z-Transform: The direct Z-transform, properties of the Z-transform, rational Z-transforms, inversion of the Z transform, analysis of linear time-invariant systems in the Z-domain, block diagrams and signal flow graph representation of digital network, matrix representation.

Unit – III Frequency Analysis of Discrete Time Signals: Discrete Fourier Series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two dimensional DFT, circular convolution.

Unit – IV Efficient Computation of the DFT: FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for 'N' composite number.

Unit – V Digital filters Design Techniques: Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques rectangular and other windows, examples of FIR filters, design using windowing.

References:

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.
2. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI Learning.
3. Proakis: Digital Signal Processing, Pearson Education.
4. Rabiner and Gold: Theory and Application of Digital Signal Processing, PHI Learning.
5. Ingle and Proakis: Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.

EEC-705(B) Advanced Microprocessor

Unit – I Introduction: Need of advance microprocessors, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, ARM processor family, Development of ARM architecture

Unit –II The ARM Architecture and Programmers Model : The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance, The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, Core extensions, Architecture revisions, ARM development tools

Unit –III ARM Instruction set: Data processing instructions, Arithmetic and logical instructions, Rotate and barrel shifter, Branch instructions, Load and store instructions, Software interrupt instructions, Program status register instructions, Conditional execution, Multiple register load and store instructions, Stack instructions, Thumb instruction set, advantage of thumb instructions, Assembler rules and directives, Assembly language programs for shifting of data, factorial calculation, swapping register contents, moving values between integer and floating point registers

Unit – IV Memory Management Units: Moving from memory protection unit (MPU) to memory management unit (MMU), Working of virtual memory, Multitasking, Memory organization in virtual memory system, Page tables, Translation look aside buffer, Caches and write buffer, Fast context switch extension

Unit – V Advanced Microprocessor Bus Architecture (AMBA) Bus System: User peripherals, Exception handling in ARM, ARM optimization techniques

References:

1. ARM Assembly Language Programming & Architecture By. Muhammad Ali Mazidi, Kindle edition
2. Arm Assembly Language, Fundamentals and Techniques, 2nd edition, William Hohl, Christppher Hinds, CRC Press.
3. Arm System Developer's Guide, Designing and Optimizing Software, Andrew N. Sloss, Dominic Symes, Chris Wwight, Elsevier
4. Arm System-on-chip Architecture, 2nd Edition, Steve Furber, Pearson publication
5. Embedded Systems By. Lyla Das, Pearson publication

EEC-705(C) Demand Side Management

Unit I Introduction to Energy Auditing: Energy Situation – world and India, energy consumption, conservation, codes, standards and legislation, energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, sankey diagrams, load profiles, energy conservation schemes. measurements in energy audits, presentation of energy audit results.

Unit ii Demand Side Management Basics : Introduction to DSM, concept of DSM, benefits of DSM, different Techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning.

Unit III Demand Side Management for load: Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. management and organization of energy

Unit IV Economics Of DSM: Basic payback calculations, depreciation, net present value calculations, taxes and tax credit – numerical problems. importance of evaluation, measurement and verification of demand side management programs.

Unit V Cost Effectiveness Tests of DSM: Cost effectiveness test for demand side management programs - ratepayer impact measure test, total resource cost, participant cost test, program administrator cost test numerical problems: participant cost test, total resource cost test and ratepayer impact measure test.

References:

1. Demand Side Management Jyothi Prakash, TMH Publishers.
2. Clark W. Gellings, John H. Chamberlin, Demand-side management : concepts and methods, 2 nd Edition, Prentice Hall, 1 May 1993
3. Aníbal T. de Almeida, Arthur H. Rosenfeld, Demand-side management and electricity end use efficiency, 1 st Edition, Springer, Softcover reprint of the original, 28 October 2011
4. R. K. Pachauri & P. Mehrotra , India Vision 2020

EEC-706(A) System Engineering

Unit I- Systems Engineering: Role, Purpose and Value Mission, definitions, codes of practice, competencies, relation to other corporate functions, marketing, risk-management, business performance, time-to-market

Unit III Systems Engineering Organization: Life cycle process models—waterfall, helix, prototyping, simultaneous/concurrent, evolutionary acquisition, Sashami, chaotic, regression, etc. The engineering and application systems model. The 5 systems model. Engineering environments; ATMOSPHERE, SEAMS, system factory

Unit III Methods, Modelling and Mathematics: Principles of systems creativity, system theory, dynamic systems, simulation models, queuing models, linear and non-linear control models, stochastic models, statistics. Creative methods: Ishikawa, Majaro, Causal Loop Modelling, stakeholder analysis, interpretive structural modelling.

Unit Iv Evaluating Systems: Efficiency, effectiveness, cost-effectiveness; net contribution; tradeoffs, ranking methods, weighting and scoring methods

Unit V Requirements Enquiry: soft systems methodology, hierarchical issue method. Requirements definition. TRIAD building system. Requirements specification, compliance and certification specification.

References:

1. Benjamin S. Blanchard and Wolter J. Fabrycky, Systems Engineering and Analysis, 5th ed., Prentice Hall
2. International Series in Industrial and Systems Engineering, (Upper Saddle River, NJ), 2006. ISBN-13: 978-0-13-221735-4

EEC-706(B) Embedded System

Unit I: Introduction to Embedded System: Categories, Requirements, Applications, Challenges and Issues. Core of Embedded system, Memory, Sensors and Actuators, communication interface, embedded firmware, system components.

Unit II: Computational Models: Fundamental issues of hardware software co-design, computational models in embedded design data flow graph, control flow graph, state machine model, sequential programmed model, concurrent model, unified modeling language.

Unit III: 8085 Microcontroller: Architecture of 8085 microcontroller, memory organization, registers, interrupts, addressing modes, instruction sets.

Unit IV: Embedded Firmware Design Approaches- OS based, Super loop based. Embedded firmware development languages- Assembly language based, high level language based, mixed, Programming in embedded C.

Unit V: Task operation: Types of Operating system, Task, process and threads, Multi processing and multi task, Task scheduling, Task communication, Task synchronization.

References:-

1. Shibu K V, "Introduction to Embedded System", TMH.
2. David E Simon, "An Embedded Software Primer", Pearson education Asia, 2001.
3. Steven F. Barett, Daniel J. Pack, "Embedded Systems" Pearson education, First Impression 2008.
4. Vahid Frank, Tony Givargis, "Embedded System Design", John Wiley and Sons, Inc.
5. Dream Tech Software Team, "Programming for Embedded Systems" Wiley Publishing house Inc.
6. Sriram V Iyer, Pankaj Gupta, "Embedded Real time Systems Programming", TMH.
7. Raj Kamal, "Embedded Systems", TMH.

EEC-706(C) Fuzzy Logic System

Unit I-Classical & Fuzzy Sets: Introduction to classical sets – properties, operations and relations; fuzzy sets, membership, uncertainty, operations, properties, fuzzy relations, cardinalities, fuzzy, properties of fuzzy sets.

Unit II-Membership Functions: Features of the membership function, standard forms and boundaries, fuzzification, membership value assignments – intuition, inference, rank ordering, angular fuzzy sets,

Unit III-Fuzzy Logic System Components: Fuzzification, development of rule base and decision making system, defuzzification to crisp sets, defuzzification methods.

Unit IV-Application: Fuzzy logic control – inverted pendulum – image processing – home heating system – blood pressure during anesthesia – introduction to neuro fuzzy controller.

Unit V-Fuzzy Associative Memories: Fuzzy systems as between-cube mappings, fuzzy and neural function estimators, fuzzy hebb FAMs, adaptive FAMs: product-space clustering in FAM cells.

References:-

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.
3. Klir.G, Yuan B.B. "Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
4. Fuzzy Logic and Fuzzy Decision Making Paperback – 26 Jun 2008 by Dr G Kannan

EEC- 707-Industrial Training - II

Students must observe following points to enrich their learning in electrical engineering during industrial training:

- The training must be the advance/ different already done on minor training.
-Industrial environment and work culture.
- Organisational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.
- Quality control and assurance.
- Maintenance system.
- Costing system.
- Stores and purchase systems.
- Roles and responsibilities of different categories of personnel.
- Customer services.
-Problems related to various areas of Work etc.
- Layout if any

To be submitted : The students has to submit the power point presentation of minimum15 slides of the training performed(comprising of points stated above) along with the original certificate of training performed with proper seal and signature of the authorized person.