EE601- Switchgear and 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, elementary principles of 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 ,types ,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 International reprint 2006.
3. Badrirka, Power System protection and switchgear, TMH
4. Haddi Saadet, Power System Analysis, TMH
5. Switchgear & protection Sunil S. Rao. Khanna Publication

List of Experiments:

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.

EE-602 Power System - II

Unit-I Mechanical Features of Overhead Lines: Conductor material and types of conductor, conductor arrangements and spacing, calculation of sag and tension, supports at different levels, effect of wind and ice loading, stringing chart and sag template, conductor vibrations and vibration dampers.

Unit-II Parameters of Transmission Lines: Resistance, inductance and capacitance of overhead lines, effect of earth, line transposition, GMD and distance, inductance and capacitance of line with symmetrical and unsymmetrical spacing, inductance and capacitance of double circuit lines, skin and proximity effects, equivalent circuits & performance of short, medium and long transmission lines.

Unit-III Insulators: Pin, shackle, suspension and strain insulators, voltage distribution across insulator string, grading and methods of improving string efficiency.

Unit-IV Underground Cables: Conductor, sheathing and armoring materials, types of cables, insulator resistance and capacitance calculation, electrostatic stresses and reduction of maximum stresses, causes of breakdown, thermal rating of cable, introduction to oil filled and gas filled cables.

Unit-V Economic Scheduling of Power Stations: Economic operation of power system, criteria of loading of power plants with and without transmission loss, load dispatching in power system, calculation of cost of generation, fixed charges, interest and depreciations methods of depreciation, power factor improvement.

References:

1. B. R. Gupta: Power System Analysis & Design, S. Chand Publishers. 2008
2. Soni, Gupta and Bhatnagar: A Course in Electrical Power, Dhanpat Rai. 1987
3. C. L. Wadhwa Electrical Power Systems, New Age. 2009
4. Nagrath Kothari: Modern Power System Analysis, MGH. 2011
5. J. J. Grainger & W. D. Stevenson: Power System Analysis, MGH. 2003
6. Kamaraju: Electrical Power Distribution Systems, MGH.

List of Experiment (Extendable):

1. Electrical design of transmission line.
2. Mechanical design of transmission line.
3. Drawing of Tower structure.
4. Drawing of insulators.
5. Drawing of cables.
6. Determination of transmission line parameters using MATLAB.

EE- 603 Utilization of Electrical Energy

Unit-I Illuminations: Definitions, laws of illuminations, polar curves, luminous efficiency, photometer, incandescent lamps, filament materials, halogen lamp, electric discharge lamps, sodium vapor lamp, mercury vapour lamp, fluorescent lamp, light calculations: commercial, industrial, street and flood lighting

Unit-II Electric Heating: Different methods of electric heating, principle of high frequency induction and dielectric heating, construction, operation, performance and applications of arc furnace and induction furnace

Electric Welding: Welding process, welding transformer, classification of electric welding: arc welding, resistance welding, welding of various metals.

Unit-III Electrolytic Process: Principles and applications of electrolysis, electro-deposition, manufactures of chemicals, anodizing, electro-polishing , electro-cleaning, electroextraction, electro-refining, electro-stripping (parting) power supplies for electrolytic process.

Unit-IV Electric Traction: Systems of Electric Traction: DC & AC Systems, power supply for electric traction system: comparison and application of different systems, sub-station equipment and layout, conductor rail & pantograph.

Unit-V Traction Methods and control: Types of services, speed time and speed distance curves, estimation of power and energy requirements, mechanics of train movement, Co-efficient of adhesion, adhesive weight, effective weight, traction motor controls: DC and AC traction motors, series parallel starting, methods of electric braking of traction motors.

References:

1. C. L. Wadhwa: Utilization of Electric Traction Electric Power. 1989
2. H. Partab: Art and Science of Electrical Energy, Dhanpat Rai & Sons
3. Gupta, J.B., Utilization of Elect. Energy , Katariya and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect. Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect.

EE 604- Microprocessor and Microcontrollers

Unit-I History of computers: Timing and control, memory devices: semiconductor memory organization, 8-bit microprocessor (8085): Architecture, types of instructions, instruction set, addressing modes, flag register of 8085, and memory segmentation.

Unit-II 16-bit Microprocessors (8086/8088): Architecture, physical address, flag registers, memory organization, bus cycle, addressing modes, instruction set difference between 8086 and 8088, introduction to 80186 and 80286, assembly language programming of 8086/8088

Unit –III Data Transfer Schemes: Introduction, types of transmission, 8257 (DMA), 8255 (PPI), serial data transfer (USART 8251), keyboard-display controller (8279), Programmable Priority Controller (8259)

Unit-IV Programmable Interval Timer/ Counter (8253/8254): Introduction, modes, interfacing of 8253, applications, ADC and DAC: Introduction, DAC converters, ADC converters, DAC and ADC interfacing and applications.

Unit -V Microcontroller (8051): Introduction, architecture, instruction set, addressing modes, registers, memory organization, timers/counters, interrupts, addressing modes, 8051 instruction set , applications of microcontrollers.

References:

1. Hall Douglas V.,Microprocessor and interfacing, Revised second edition 2006, Macmillan, McGraw Hill .
2. A.K. Ray & K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architecture, Programming and Interfacing, Tata McGraw – Hill, 2009 TMH reprint.
3. Kenneth J. Ayala, The 8086 microprocessor: programming and interfacing the PC, Indian -edition, CENGAGE Learning.
4. Muhammad Ali Mazidi and Janice Gillespie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson education, 2005.
5. Kenneth J. Ayala, The 8051 Microcontroller Architecture, III edition, CENGAGE Learning.
6. Microprocessor Architecture, Programming and Applications with the 8085 6/e
   October 2013, Ramesh Gaonkar.

List of Experiment:

1. To study 8085 based microprocessor system.
2. To study 8086 based microprocessor system.
3. Write an Assembly Language Program to add two 16 bit numbers.
4. Write an Assembly Language Program to subtract two 16 bit numbers.
5. To perform multiplication/division of given numbers.
6. To perform computation of square root of a given number.

7. To obtain interfacing of RAM chip to 8085/8086 based system
8. To develop and run a program for finding out the largest/smallest number from a given set of numbers.

EE 605 – Energy Conservation & Management

Unit-I General Energy Problem: Energy use patterns and scope for conservation, energy audit, energy monitoring, energy accounting analysis, and targeting, energy management, types of energy audit, qualities and function of energy managers, language of an energy manager, check list for top management, loss of energy in material flow, energy performance, maximizing system efficiency, input energy requirements, energy auditing instruments, material load energy balance diagram.

Unit- III Thermodynamics of Energy Conservation: Basic principle, irreversibility, second law, efficiency analysis of systems, primary energy sources, optimum use of prime-movers, energy recovery in thermal systems, waste heat recovery techniques, thermal insulation, thermal energy audit in heating, ventilation and air conditioning, friction, lubrication, predictive and preventive maintenance.

Unit-III Load curve analysis: Load curve analysis & load management, DSM, energy storage for power systems (mechanical, thermal, electrical & magnetic), restructuring of electric tariff from energy conservation consideration, economic analysis depreciation method, time value of money, evaluation method of projects, replacement analysis, pay back period, energy economics, cost benefit risk analysis,

Unit-IV Energy Efficient System: Energy efficient electric drives, energy efficient house keeping, energy efficient motors, energy flow networks, simulation & modeling, matrix chart.

Unit-V Energy conservation: Energy conservation policy, energy conservation task before industry, energy conservation equipment's , co-generation, energy conservation process, energy conservation in transportation system in electric vehicle industry, sugar, textiles, cement industries, electrical energy conservation in building, heating, lighting & domestic gadgets .

References:

1. Energy Management – W.R. Murphy & G. Mckey Butler worths.
2. Energy Management Head Book- W.C. Turner, John Wiley.
3. Energy Management Principles- Craig B. Smith, Pergamon Press.
4. Energy Conservation- Paul O Callagan- Pergamon Press.
5. Design & Management of energy conservation. Callaghan.
6. Elect, Energy Utilization & Conservation. Dr. Tripathi S.C.

EE 606 - Minor Project

The selection of topic should be from the subjects the student has studied so far or any topic related to real life problem. He should do the literature survey, analyze the problem and propose some solution for the same. The analysis of the problem may be done with the help of some software or any hardware (which may be made by the student).Following points are important:

1. Presentation of project with the help of power point presentation at the end of the semester is compulsory.

2. A detailed report regarding the topic should be submitted before the internal examination