

## **PTEX- 601 - Utilisation of Electrical Energy**

### **Unit-I**

**Illumination Engineering:** Nature of light, units, sensitivity of the eye, luminous efficiency, glare. Production of Light; Incandescent lamps, arc lamps gas discharge lamps- fluorescent lampspolar curves, effect of voltage variation on efficiency and life of lamps, Distribution and control of light, lighting calculations, solid angle, inverse square and cosine laws, methods of calculations, factory

lighting, flood lighting and street lighting, Direct diffused and mixed reflection & transmission factor, refractors, light fittings.

### **Unit-II**

**Heating, Welding And Electrolysis:** Electrical heating-advantages, methods and applications, resistance heating, design of heating elements, efficiency and losses control. Induction heating: core type furnaces, core less furnaces and high frequency eddy current heating, dielectric heating: principle and special applications, arc furnaces: direct arc furnaces, Indirect arc furnaces, electrodes, design of heating elements, power supply and control. Different methods of electrical welding, resistance welding, arc welding, energy storage welding, laser welding, electron beam welding, and electrical equipment for them. Arc furnaces transformer and welding transformers. Review of electrolytic principles, laws of electrolysis, electroplating, anodizing- electro-cleaning, extraction of refinery metals, power supply for electrolytic process, current and energy efficiency.

### **Unit-III**

#### **Traction**

Special features of Traction motors, selection of Traction Motor, Different system of electric traction and their Advantages and disadvantages, Mechanics of train movement: simplified speed time curves for different services, average and schedule speed, tractive effort, specific energy consumption, factors affecting specific energy consumption, acceleration and braking retardation, adhesive weight and coefficient of adhesion,

## **Unit-IV**

### **Electric Drives**

Individual and collective drives- electrical braking, plugging, rheostatic and regenerative braking load equalization use of fly wheel criteria for selection of motors for various industrial drives, calculation of electrical loads for refrigeration and air-conditioning, intermittent loading and temperature rise curve.

## **Unit-V**

### **Introduction to Electric and Hybrid Vehicles**

Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption.

### **TEXT BOOK:**

1. Open Shaw ,Taylor, .Utilization of electrical energy., Orient Longmans, 1962.
2. H. Pratap, Art and Science of Utilization of Electrical Energy.
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. Traction, New Age International.
6. Hancock N N, Electric Power Utilisation, Wheeler Pub.
7. Mehrdad,Ehsani,Yimin Gao,Sabastien.E. Gay,Ali

## **PTEX- 602 – Control Systems**

### **Unit-I**

Modeling of dynamic systems: Electrical, Mechanical and hydraulic systems, Concept of transfer function, Simulation of differential equations in analog computer, State space description of dynamic systems: Open and closed loop systems, Signal flow graph, Mason's formula, Components of control systems: Error detectors (Synchros & Potentiometer), Servomotors (AC & DC), techo generators, power amplifier, stepper motors

### **Unit-II**

Time – domain analysis of closed loop systems: Test signals, time response of first and second order systems, Time domain performance specifications, Steady state error & error constants  
Feedback control actions: Proportional, derivative and integral control. Solution of state equation: Eigen values & eigenvectors digitalization state transitive matrix, stability Routh-Hurwit stability analysis.

### **Unit-III**

Characteristics equation of closed loop system root loci, construction of loci, Effect of adding poles and Zeros on the loci, Stability by root loci.

### **Unit-IV**

Frequency Domain analysis: Bode plots, Effect of adding poles and Zeros, Polar plot, Nyquist stability analysis, Relative stability : Gain and phase margins.

### **Unit-V**

Frequency- Domain compensation : Lead, Lag, Lag-lead compensation, Design of compensating networks

**TEXT BOOK:**

1. I.J. Nagrath and M. Gopal, "Control system Engineering", New Age International.
2. Modern Control Systems by Roy Chaudhary. PHI
3. K. Ogata, Modern Control Engineering, PHI.
4. B.C. Kuo, Automatic Control systems, PHI
5. Gopal M., Control System : Principles & Design, TMH.
6. Stefani, Shahian, Savant, Hostetter, "Design of feed back control System's", Oxford.
7. Krishna. K. Singh & Gayatri Agnihotri, System Design through MATLAB control tool & Simulink, Stringer Verlag, U.K.
8. Rudra Pratap, Getting Started with MATLAB, Oxford.
9. Dhanesh N.Manik, Control Systems, CENGAGE Lea

**List of Experiments:**

1. Time response of second order system.
2. Characteristics of Synchros.
3. Effect of feedback on servomotors.
4. Determination of transfer function of A-C servomotor
5. Determination of transfer function of D-C motor.
6. Formulation of PI & PD controller and study of closed loop responses of 1st and 2nd order dynamic systems.
7. State space model for classical transfer function using MATLAB.
8. Simulation of transfer function using operational amplifier.
9. Design problem: Compensating Networks of lead and lag.
10. Temperature controller using PID.
11. Transfer function of a DC generator.
12. Characteristics of AC servomotor.
13. Use of MATLAB for root loci and Bode plots of type-1, type-2 systems.
14. Study of analog computer and simulation of 1st order and 2nd order dynamic equations.
15. Formulation of proportional control on 1st order and 2nd order dynamic systems.

## **PTEX- 603 – Switchgear & Protection**

### **UNIT-I**

**Fault Analysis:** Fault Analysis per unit, representation and its advantages, faults in power systems (Symmetrical & Unsymmetrical), Single line and equivalent impedance diagram representation of power system components. Symmetrical components and its application to power systems, fault analysis, Sequence networks and their interconnection for different types of faults, Effect of fault impedance, Current limiting reactors, its location and application, Short circuit calculation.

### **Unit-II**

**Protective Relays:** Requirement of relays, Primary & backup protection, Desirable qualities of relays, Concept of Pickup, reset & drop-off, Drop off/ Pickup ratio, inverse time & definite time characteristics, Attracted armature, Balanced Beam, Induction disc, Induction cup, Moving coil & moving Iron, Rectifier, Thermal, Bimetal directional relay, Frequency, DC, all or nothing relays. Pilot & negative sequence, over current, Over Voltage, Directional, Differential and Distance relays, R-X diagram, Impedance mho & reactance relay. Introduction of static analog & digital relays, Classification of static relays.

### **Unit-III**

**Circuit Breakers:** Elementary principle of arc quenching, recovery & re-striking voltage, arc quenching devices, description and operation of Bulk oil, Minimum oil, Air break, Air blast, SF<sub>6</sub>, Vacuum circuit breakers and DC circuit breakers, their comparative merits, LT Switch gear, HRC fuses, current limiting reactor & their design features, influence of reactors in CB ratings Testing of circuit breaker, Description of a simple testing station, direct & indirect testing.

### **Unit-IV**

**System Protection:** Protection of Generators - Earth Fault, percentage, differential, Loss of excitation, Prime mover failure, Over current, Turn to turn fault, Negative phase sequence, heating, Reverse power protection schemes

### **Protection of Transformers**

Internal & external fault protection, Differential, Earth fault, Over Current, Overheating, Protection schemes, Protection of transmission lines, Over current, Distance and carrier current protection schemes.

## **Unit-V**

### **Surge Protection & insulation co-ordination**

Switching surges, Phenomena of Lightning, over voltage due to lightning, Protection against lightning, Lightning arrestors, selection of lightning arrestors, Surge absorbers and diverters, Rod gap, Horn gap expulsion type & valve type lightning arrestors, solid resistance and reactance earthing, Arc suppression coil, Earthing transformers, Earthwires, Earthing of appliances, insulation co-ordination, Definitions determination of line insulation, insulation level of substation equipment, co-ordination amongst items of substation equipment.

### **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. Determination of transmission line parameters using MATLAB.
7. Analysis of power system faults (Symmetrical & Asymmetrical) using MATLAB.
8. Study of SF6 circuit breaker
9. Protectional simulation study of generator, Transformer, Feeder & Motor protection.

### **TEXT BOOK:**

1. B. Ravindran and M Chander, "Power System protection and Switchgear", New Age International.
2. Badrirka, Power System protection and switchgear, TMH.
3. CL Wadhwa, Electrical Power systems, New age International.
4. Haddi Saadet, "Power System Analysis, TMH
5. A.R. Bergen, Vijay Vittal, "Power System Analysis, Pearson Education, Asia.
6. Switchgear & protection Sunil S. Rao. Khanna Publication.
7. Ravindra P. Singh, Switchgear & Power System Protection, PHI Learning

## **PTEX- 604 MICROPROCESSOR & MICROCONTROLLERS**

### **UNIT 1:**

Microprocessor 8086 Introduction to 16-bit 8086 microprocessors, architecture of 8086, Pin Configuration, interrupts, minimum mode and maximum mode, timing diagram, Memory interfacing, Comparative study of Salient features of 8086, 80286 and 80386.

UNIT 2: Microprocessor 8086 programming Instruction set of 8086, Addressing mode, Assembler directives & operations, assembly and machine language programming, subroutine call and returns, Concept of stack, Stack structure of 8086, timings and delays,

UNIT 3: Input-Output interfacing: Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 8254, USART 8251, 8 bit ADC/DAC interfacing and programming.

UNIT 4: Microcontroller 8051 Intel family of 8 bit microcontrollers, Architecture of 8051, Pin description, I/O configuration, interrupts; Interrupt structure and interrupt priorities, Port structure and operation, Accessing internal & external memories and different mode of operations, Memory organization, Addressing mode, instruction set of 8051 and programming.

UNIT 5: 8051 Interfacing, Applications and serial communication 8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/ counter functions, 8051 based thyristor firing circuit, 8051 connections to RS-232, 8051 Serial communication , Serial communication modes, Serial communication programming, Serial port programming in C.

### **List of Experiments**

1. Introduction to 8086 & 8051 kit, hardware features & modes of operation.
2. Technique of programming & basic commands of kit.

3. Write a program to find 1's complement and then 2's complement of a 16-bit numbers.
4. Write a program to find larger of two numbers.
5. Write a program to shift an 8-bit number left by 2-bits.
6. Write a program to multiply two 16-bit numbers .

#### BOOKS:

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. V.Udayashankara and M.S.Mallikarjunaswamy, 8051 Microcontroller: Hardware, Software & Applications, Tata McGraw – Hill, 2009.
7. McKinlay, The 8051 Microcontroller and Embedded Systems – using assembly and C, PHI, 2006 / Pearson, 2006.