

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code: EL20611

Subject: Utilization of Electrical Energy

Minimum number of Class tests to be conducted: 2

UNIT-I

Electric Drives:

Advantages of electric drives, Characteristics of different mechanical loads, Parts of electric drives electric motors, close loop of electric drive system, Types of motors used in electric drive pulley drives etc., Examples of selection of motors for different types of domestic loads, Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc.

UNIT-II

Illumination:

Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux, Laws of illumination, Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour lamp, fluorescent lamp, metal halide lamp, neon lamp, Main requirements of proper lighting; absence of glare, contrast and shadow, General ideas about street lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc.

UNIT- III

Electric Heating :

Advantages of electrical heating, Heating methods: Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances and thermostat control circuit, Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace

UNIT -IV

Electric Welding:

Advantages of electric welding, Welding method, Principles of resistance welding, types, Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method of and their applications.

UNIT- V

Electrical Circuits used in Refrigeration and Air Conditioning and Water Coolers:

Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly Refrigerants, Electrolytic Processes, Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing.

Text Books:

1. "Utilization of electrical energy" by E.O.Taylor.
2. "Electrical Drives: Concept and applications" by Vedam Subrahmanyam" THM.

Ref. Books:

1. "Art and Science of Utilisation of Electrical Energy" by H.Pratab, Dhanpat Rai & Co.

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code:EL20612

Subject: Electrical Machine-II

Minimum number of Class tests to be conducted: 2

UNIT I: Electrical Machines Principles

Principle of electromechanical energy conversion. Construction of various rotating machines. Singly excited magnetic system, co-energy and field energy. Doubly excited magnetic system. Winding factors, MMF of concentrated and distributed windings, rotating magnetic fields.

UNIT II: Non-salient pole synchronous machines

Theory of non-salient pole synchronous machines, equivalent circuit and phasor diagrams of synchronous machines, saturation effects, armature reaction, open circuit, short circuit and zero power factor lag tests on synchronous machines, synchronous reactance, SCR, voltage regulation of alternators by synchronous impedance, MMF and zero power factor method, Steady state power angle characteristics, Excitation systems of alternators

UNIT III: Salient synchronous machines

Theory of salient pole synchronous machines, two- reaction theory, phasor diagram, power angle characteristics, determination of X_d and X_q , phasor diagrams, parallel operation of synchronous machines, load sharing, operation of synchronous machines with infinite bus bars, synchronizing torque, active and reactive power flows.

UNIT IV: Synchronous Motor

Synchronous motor: Construction, general load/phasor diagram, Torque and power in salient and non salient pole motors, V-curves, Capability curve, synchronous condenser, starting of synchronous machines, damper winding, Hunting, Applications.

UNIT V: Polyphase Induction Machines

Cage and slip-ring induction motors, equivalent circuit, phasor diagram, torque-speed (slip) relationship, testing of induction motors, Circle diagram. starting and speed control of induction motors, cogging and crawling, double cage induction motors.

Text Books:

1. Electrical Machines by Smarajit Ghosh, Pearson Education
2. Electric machinery by Kingsley, Fitzgerald and Umans, TMH

Reference Books:

1. Electric Machines by Nagrath & Kothari, TMH Pbs.
2. Electric Machines by P.K. Mukherjee & S.Chakravarti, Dhanpat Rai
3. Electrical machines by B. R, Gupta, New age international.

Performance & Design of A.C. Machines by M.G. Say, C.B.S. Publishers **Code:**

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code: EL20613

Subject: Power System Analysis

Minimum number of Class tests to be conducted: 2

UNIT I

Symmetrical Three-Phase Short Circuit

Calculation of interrupting capacity of circuit breakers, current limiting reactors, symmetrical components, synthesis of unbalanced phasors from symmetrical components, representation of phase variables voltage, current and power in terms of symmetrical components, sequence impedances of power system elements, sequence networks of power system elements, phase shift in star-delta transformer banks.

UNIT II

Unsymmetrical Short Circuits

Single line-to-ground, line-to-line, double-line-to-ground faults on unloaded alternators, unsymmetrical faults on power systems, fault through impedance, open conductor faults.

UNIT III

Power System Stability

The stability problem, steady-state stability, transient stability, Swing equation, Equal area criterion of stability, application of equal area criterion, step-by-step solution of the swing equation, factors affecting transient stability,

UNIT IV

Load Flow Studies

Formulation of bus admittance matrix, formulation of load-flow equations and their solution techniques, digital computer techniques, reactive power optimization.

UNIT V

Automatic Generation & Voltage control

Introduction, single area and two area load frequency control, and Economic dispatch control, optimal (two area) load frequency control, automatic voltage control, Tie-line bias control.

Text Books:

1. Modern power system analysis, Nagrath and Kothari, TMH
2. *Power System Analysis*", Haddi Saddat, TMH

Reference books:

1. "*Electrical Power Systems*", Ashfaq Hussain, CBS Pbs.
2. Electrical energy system theory, Elgerd, TMH.
3. Power system analysis, Bergen, Pearson Pbs
4. "*Power System Analysis*", Grainger and Stevenson, TMH Pbs.

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code:EL20614

Subject: Power System Protection & Switchgear

Minimum number of Class tests to be conducted: 2

UNIT-I

Relays:

Terminology, Basic circuit, relay connection with trip circuit and circuit breaker, objectives of protection, types of relay, construction and operation of instantaneous over current relay. IDMT Relay, directional Unit, differential relay, percentage differential relay, Buchholz relay, Generalized torque expression, logical construction of impedance reactance, MHO and Off-set MHO Relays using generalized torque expression.

UNIT-II

Protection of Alternators & Transformers:

Differential protection of alternator, Protection of stator against phases to ground fault, phase to phase faults, inter turn fault, protection against unbalanced loading, protection of rotor against ground fault, field failure, reverse power, back up protection, field suppression, protection of bus bars, frame leakage protection. Differential protection of transformers for different winding configurations, difficulties encountered in differential protection and their remedies,

UNIT III

Protection of Transmission Lines:

Over current protection, directional o/c, distance protection, unit protection schemes, carrier aided distance protection, protection of feeders, protection of ring main and parallel feeders, protection of radial feeders by over current relays, distance relays and carrier current protection scheme.

UNIT IV

Static and Numerical Relays:

Amplitude and phase comparator techniques, directional relay, impedance relay, admittance relay, description of numerical relays, relaying algorithms, use of numerical relays as fault locator and disturbance recorder.

UNIT V

Circuit Breakers and Fuses:

Arc formation, arc interruption and restriking voltage, current chopping, resistance switch, Air blast circuit breakers, minimum and bulk oil circuit breakers, SF6 and Vacuum Circuit breakers, circuit breakers rating, testing of CB, point on wave switching, Definitions of terms in fuses, HRC fuses.

Text Books:

1. "Power system protection and switchgear", Ravindranath and Chander, TMH
2. "Fundamentals of power system protection", Paithankar and Bhide, PHI

Reference books:

1. "Electrical power system", Wadhwa, New Age.
2. "Power system protection", Badri Ram, TMH.

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code:EL20615

Subject MICROPROCESSORS

Minimum number of Class tests to be conducted: 2

Unit -I: Microprocessors Architecture & Interfacing:

- (a) Introduction: Basic concepts of microprocessors and microcomputers, Introduction to microprocessor based systems, single chip microprocessor, and microcontrollers.
- (b) Architecture & microcomputer systems: Architecture and operations of microprocessors in general, memory, I/O devices, and logic devices for interfacing, assembler and cross- assembler, bit- slice microprocessors.
- (c) Architecture & memory interfacing: Architecture of INTEL 8085, pin diagram, internal registers, bus timings, control signals, ALU, machine cycle, read and write timing requirements in 8085.
- (d) Interfacing I/O devices: Basic concepts of interfacing, output displays and input devices, memory mapped I/O & I/O mapped I/O.

Unit -II: Programming the 8085:

- (a) Introduction to 8085 programming: Instruction classification, instruction format, opcode format, flowchart, 8085 instruction set.
- (b) 8085 Instructions: Data transfer operations, addressing modes, arithmetic logic and branch operations, writing an assembly language program.
- (c) Programming Techniques: Looping, counting, indexing, 16 bit arithmetic operations, data transfer and arithmetic operations related to memory, logic operations.

Unit -III: Microprocessors operations and programming:

- (a) Counter & time delays with illustrative programs for HEX counter, module-n counter, generating pulse waveforms etc.
- (b) Stacks & Subroutines with illustrative programs.
- (c) Write assembly language program for code conversion, BCD arithmetic and 16 bit data operations.
- (d) Input/output ports, programmable I/O ports, programmable Peripheral interface, programming the 8255 A, Programmable Interrupt controller (8259), Programmable DMA controller (8257), Communication Interface (The 8251 USART).

Unit -IV: Interfacing peripherals:

- (a) Interrupts: 8085 interrupts, vector interrupts ,RSTs.
- (b) Interfacing D-A and A-D converters.
- (c) SDK-85 programmable Interface Devices: 74LS245 programmable transceiver, hand shake signals, control words, 8155/8156 and 8355/8755 programmable devices.

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Subject MICROPROCESSORS(continue.....)

- (d) General purpose programmable peripheral devices: 8255A, status word, 8254/8253 timer, 8259 interrupt controller, 8257 DMA controller.

Unit -V: Microprocessors application & Design:

- (a) Serial I/O & Data communication: Basic concepts, software and hardware controlled synchronous and asynchronous serial transmission, baud-rate, error checks, RS-232-C.
- (b) Microprocessor applications and design: Designing scanned display, matrix keyboard, memory design.
- (c) Recent trends in microprocessors technology: Architectural features of 8/16/32 bit microprocessors of Intel, Zilog, and Motorola etc. Single chip microcontrollers, selected case studies.
- (d) Introduction of microcontroller, 8051 microcontroller

Test Book:

1. "Microprocessor architecture , programming and application with 8085" Ramesh S. Gaonkar, Wiely Pbs.

Reference Books:

1. Microprocessors and interfacing: "Programming and hardware "Douglas V Hall, Tata-Mc-graw Hill Edn.
2. Introduction to microprocessors, Aditya P. Mathur, TMH Pbs
3. Fundamental s of microprocessors and microcomputers", B.Ram, Dhanpat Rai

Microprocessors lab

1. Familiarity with microprocessoes and microcontroller kits.
2. Use of assembly language programming on μ P kits with and without assembler, writing programs for number manipulation.
3. Selected excercises in interfacing selected peripherals to these kits.
4. Lab projects involving design fabrications and testing of 8-bit μ P based minimum configurations.

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code:EL20634

Subject: HVDC POWER TRANSMISSION (ELECTIVE – I)

Minimum number of Class tests to be conducted: 2

Unit-I

Thyristors valve : thyristors devices, steady state switching characteristic, light activated power thyristors, valve firing, parallel & series connection of thyristors

Unit-II

Converter Circuit : Rectification, The 3-phase Bridge rectifier or Graetz circuit, Inversion, Kinds of D.C links, Paralleled and Series connection of thyristors, Power flow in HVDC transmission system. Converter Station: Major components of a converter station-converter unit, filters, reactive power source. Ground return and ground electrode.

Unit-III

Basic principles of DC link control: Converter control characteristics, firing angle control and extinction angle control. Parallel operation of D.C. link with A.C. transmission line, Converters Fault and Protection: converter fault and protection against over current, over voltage in converter protection of DC Line and DC circuit breaker

Unit-IV

Active and Passive Filters: Reactive power control: reactive power requirement in steady state, sources of reactive power and reactive power control. Harmonics and Filters: Generation of harmonics, Characteristics and non Characteristics harmonic, types of ac filter: single tuned and double tuned filter, high pass filter, DC smoothing reactor and filters

Unit-V

Multi-terminal Types of MTDC system: comparison of series and parallel MTDC system, control and protection of MTDC system and application of MTDC systems

Test Books:

1. J. Arrillaga.; High Voltage Direct Transmission; Peter Peregrinus Ltd. London, 1983.
2. E. W. Kimbark.; Direct Current Transmission, Vol.I; Wiley Interscience, 1971.

Reference Books

3. K. R. Padiyar.; HVDC Power Transmission Systems; Wiley Eastern Ltd., 1990.
4. Erich Uhlmann.; Power Transmission by Direct Current, B.S. Publications, 2004.

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code: EL20633

Subject: Artificial Neural Network & Fuzzy Systems :(ELECTIVE - I)

Minimum number of Class tests to be conducted: 2

Unit-I

INTRODUCTION TO ANN

Introduction to Network Architecture, Learning Processes, Single Layer Perceptions, Multilayer Perceptions

Unit-II

SUPERVISED LEARNING NETWORKS

Radial –Basis Function Networks, Support Vector Machines, Committee Machines

Unit-III

UNSUPERVISED LEARNING NETWORKS

Principal Components Analysis, Self-Organising Maps, Information-Theoretic Models

Unit-IV

Stochastic Machines & their Approximates Rooted:

Statistical Mechanics, Euro-dynamic Programming, Temporal Processing Using feed-forward Networks, Neuro-dynamics, and Dynamically Driven Recurrent Networks

Unit-V

Fuzzy System

Fuzzy Systems, Fuzzy sets & Relations, Fuzzy-To –Crisp Conversion, Simple Application of Fuzzy Systems

Text Book:

1. Neural Networks, A Comprehensive foundation,2nd Edition by: Simon Haykin, Pearson Education.
2. Zimmerman, H.J.”Fuzzy Set Theory & its Applications,” Allied Publishers, New Delhi, 1996.

Reference Books:

1. Dan W Patterson,” *Artificial Neural Network-Theory & Application* “, Prentice Hall of India, 1996
2. Timothy J Ross,” *Fuzzy Logic with Engineering Applications*,” McGraw Hill International Edition, USA, 1997
3. Li Min Fu,”*Neural Networks in Computer Intelligence*”, McGraw Hill, USA, 1994.
4. Kevin Warwick.; Arthur Ekwue and Raj Aggarwal .; *Artificial Intelligence Techniques in Power Systems*, The Institution of Electrical Engineers , London, 1989.
5. Bart Kosko .; *Neural networks and Fuzzy Systems*,.;Prentice Hall of India, 1990.
6. Jacek M. Zurada.; *Introduction to artificial neural Systems*, Jaico Pub.House, 2003.

National Institute of Technology, RAIPUR

B.Tech. VI Semester

Branch: Electrical Engg.

Code: EL20632

Subject: BIOMEDICAL INSTRUMENTATION (Elective-I)

Minimum number of Class tests to be conducted: 2

UNIT-I

INTRODUCTION

Physiological systems of human body: Neuronal, muscular, cardiovascular and respiratory systems, Source of bioelectric potential resting and action potential, propagation of action potential. Basics of Biomedical Instrumentation: Biometrics, basic design specifications of biomedical instrumentation system in terms of range, linearity, hysteresis, frequency response, accuracy, signal to noise ratio, stability insulation simplicity.

UNIT-II

BIOELECTRIC SIGNALS

Bioelectric signals, Microelectrodes, skin surface electrode, needle electrode, electrodes and lead systems for EEG, ECG, EMG. Transducer for biomedical applications, factors governing the selection of transducer, pressure, temperature, flow, biomedical ultrasonic transducer.

UNIT-III

MEASURING INSTRUMENTS

Blood pressure, blood flow, cardiac output, cardiac rate and heart sound measurements, electrocardiograph, phonocardiograph, plethysmograph, echocardiograph, respiratory system measurements, instrumentation for clinical laboratory, measurement of electrical activity in neuromuscular system and brain.

UNIT-IV

MEDICAL IMAGING

Medical imaging: X-ray imaging, Computer tomography (CT), Magnetic Resonance imaging, Ultrasound imaging.

UNIT-V

PATIENT MONITORING SYSTEMS

Patient care and monitoring systems, safety measures. Computer applications, biotelemetry, prosthetics and orthotics, assisting and therapeutic devices, Laser applications in medicine.

References

1. Joseph J. Carr and John M. Brown, *“Introduction to Biomedical Equipment Technology”*, 4th ed., Singapore: Pearson Education, Inc., (2001). (ISBN 81-7808-327-2)
2. Cromwell L., Weibell F. J. and Pfeiffer E. A., *“Biomedical Instrumentation and Measurements”*, 2nd ed. Singapore: Pearson Education, Inc., (2003). (ISBN 812970028X)