

**PAPER-I ELECTRICAL ENGINEERING**

**CODE NO: 259**

**UNIT – I: ELECTRICAL CIRCUITS**

Circuit elements – Kirchoff's Laws – Mesh and Nodal Analysis - Network Theorems and Applications for DC and AC circuits: Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem – Sinusoidal Steady State Analysis of RL-RC-RLC Circuits- Resonant Circuits - Natural and Forced Response – Transient Response of RL-RC-RLC Circuits-Two-port networks – Three Phase Circuits.

**UNIT – II: ELECTRIC AND MAGNETIC FIELDS**

Coulomb's Law-Electric Field Intensity-Electric Flux Density-Gauss's Law- Divergence - Electric Field and Potential due to Point, Line, Plane and Spherical Charge Distributions - Effect of Dielectric Medium - Capacitance of Simple Configurations. Magnetic Circuits- Magnetomotive force - Reluctance-Faraday's laws-Lenz's law--Biot- Savart's law - Ampere's law - Fleming's Left and Right Hand Rule-Lorentz force - Inductance - Self and Mutual Inductance-Dot Convention-Coupled Circuits.

**UNIT – III: MEASUREMENTS AND INSTRUMENTATION**

Units and Standards – Static and Dynamic Characteristics-Types of Errors-Error Analysis – Measurement of Current, Voltage, Power, Power-factor and Energy – Indicating instruments – Measurement of Resistance, Inductance, Capacitance and Frequency – Bridge Measurements – Instrument Transformers-Electronic Measuring Instruments – Multi meters-True RMS meter-Spectrum Analyzer-Power Quality Analyser- Recording Instruments-X-Y Recorder-Magnetic Recorders-Digital Data Recorder-Oscilloscopes-LED and LCD Display-Transducers and their applications to the Measurement of Non-Electrical Quantities like Temperature, Pressure, Flow-rate, Displacement, Acceleration, Noise level — Data Acquisition Systems – A/D and D/A Converters- Data Transmission Systems.

**UNIT – IV: CONTROL SYSTEMS**

Mathematical Modelling of Physical Systems – Transfer Function - Block Diagrams and Signal Flow Graphs and their Reduction using Mason's Rule – Time Domain and Frequency Domain Analysis of Linear Time Invariant (LTI) System – Errors for Different Type of Inputs and Stability Criteria for Feedback Systems – Stability Analysis Using Routh-Hurwitz Array – Nyquist Plot and Bode Plot – Root Locus – Gain and Phase Margin – Basic Concepts of Compensator Design – PI,PD and PID Controllers-State Variable Matrix – System Modeling and Design – Sampled Data System – Stability of Sampled Data System.

**UNIT –V: ELECTRICAL MACHINES**

D.C. Machines – Construction, Excitation methods – Armature Reaction and Commutation – Characteristics and Performance Analysis – Generators and Motors – Starting and Speed Control – Testing – Losses and Efficiency. Transformers- Types-Construction and Operation- Testing – Equivalent Circuits – Losses and Efficiency-All day efficiency – Regulation – Parallel Operation – Three Phase Transformers – Auto-transformer. Induction Machines – Construction, Principle of operation – Rotating Magnetic Field – Performance, Torque-Speed Characteristics, No-load and Blocked Rotor tests, Equivalent Circuit, – Starting and Speed Control – Single-Phase Induction Motors – Linear Induction Motors – Hysteresis Motors – Reluctance Motors. Synchronous Machines – Construction – Operating characteristics and Performance analysis – Efficiency and Voltage regulation – Parallel operation – V and inverted V curves of synchronous motors – Power factor improvement-BLDC Motor.

## **UNIT –VI: POWER SYSTEMS**

Single Line Diagram of Power System-Per Unit Quantities-Power Generation Types— Hydro, Thermal and Nuclear Stations – Pumped storage plants – Co generation– Economic and operating factors – Modelling and performance characteristics of Power transmission lines and Cables-HVDC transmission– Mechanical Design of Transmission Lines-Sag-Insulators - ZBus and YBus formulation - Load flow studies — Shunt and Series Compensation- Symmetrical and Un symmetrical Faults Analysis - Transient and Steady-State Stability of Power Systems – Equal Area Criterion-Voltage and Frequency Control – Power System Transients – Power System Protection – Circuit Breakers – Relays –AC and DC Distribution.

## **UNIT –VII: ANALOG AND DIGITAL ELECTRONICS**

Semiconductor Devices – PN junctions – Transistors – FET – Zener, Photo diodes and their applications – Rectifier circuits – Voltage regulators – Multipliers. Biasing circuits – Small signal amplifiers – Frequency response – Multistage amplifiers – Coupling methods – Large signal amplifiers – Push-pull amplifiers – Feedback amplifiers – Oscillators – Operational amplifiers and its applications – Precision rectifiers – Multivibrators - Voltage Controlled Oscillator-Timer. Digital logic gate families (DTL,TTL,ECL,MOS,CMOS) – Logic gates - Simplification of Logic Functions- Design of Combination circuits - Sequential logic circuits-latch–Flip- flops– Counters – Registers – Memories(ROM,PLA and FPGA).

## **UNIT – VIII: POWER ELECTRONICS AND DRIVES**

Power Semiconductor devices – Ideal and practical attributes of switch - Power Diode-DIAC - SCRs- TRIAC-GTO - power MOSFET-IGBT- Static Characteristics and Principles of Operation- Single and Three Phase AC to DC Converters – Single and Three Phase AC to AC converters –DC to DC Converters (MOSFET and IGBT based) - Single and Three Phase Inverters (MOSFET and IGBT based) - Pulse Width Modulation – Sinusoidal Modulation with Uniform Sampling – Uninterrupted Power Supplies-Switched Mode Power Supplies – Speed Control of DC and AC Motor Drives– Applications of Variable Speed Drives

## **UNIT –IX: DIGITAL PROCESSORS AND COMMUNICATION**

Architecture of 8085, 8086 and 8051 – Instruction Sets – Assembly Language Programming – Interfacing for memory and I/O: 8255 Programmable Peripheral Interface – 8253 Programmable Timer Interface – 8279 Programmable Keyboard and Display Interface – 8257 Direct Memory Access Interface - Embedded processors (ARM and PIC basics only).Classification of Signals – Properties of Discrete Fourier Transforms - FFT Computation – FIR Filters – IIR Filters: Butterworth Filters – Chebyshev Filters. Digital Communication Systems: Pulse Code Modulation and Demodulation – Adaptive Delta Modulation - Frequency Division and Time Division Multiplexing – Data Communication Network Topologies - 7-layer OSI Protocol.

## **UNIT –X: RENEWABLE ENERGY SOURCES AND STORAGE DEVICES**

Renewable Energy – Sources and Features - Solar Radiation Spectrum - Radiation Measurement-Solar Photovoltaic Cell -Operating Principle- Microhydel - Operating principle- Wind Energy Source-Wind Patterns and Wind Data- Site Selection- Types of Wind Generators-Fuel Cells-Batteries-Super Capacitors.