

## ELECTRICAL ENGINEERING

### Paper - 1

For both objective and conventional types

#### 1. Electro-magnetic circuits:

Electric and magnetic fields, terms related to magnetic circuit, Comparison between Electric and magnetic circuits and related simple problem. Conductors and magnetic materials.

#### 2. Electrical materials:

Conductors, Semi-Conductors & Insulators, Super Conductivity, Insulating materials for electrical & their applications, Magnetic materials, Ferro, Para, diamagnetic materials, Ceramics, Properties & applications, Special Semi-conductors.

#### 3. Electrical Circuits (AC & DC Circuits)

Circuit elements, Network Theorem: - Kirchhoff's Law, Thevenin's Theorem & Superposition Theorem, R-L-C Series & Parallel circuits, Series & Parallel Resonant circuits, 3-Phase circuits, Star Delta conversion. and simple problems.

#### 4. Electrical measurement & Measuring instruments:

Units & Standards

Indicating Instruments- ammeter, voltmeter, wattmeter & energy meter.  
measurement of Power, Resistance ( low, medium & high) & transducer

Bridge measurements:-

D.C. Bridge- Wheatstone Bridge & Kelvin Bridge

A.C. Bridge- Anderson Bridge, Maxwell Bridge & Wein's Bridge.

A.C. & D.C. Potentiometer & Localisation of cable fault ( Loop Test), High voltage measurement.

#### 5. Protective Devices:

Types of Relay- Over current, Over voltage, Distance, Directional & Differential

Types of Circuit Breakers- Oil C.B., Air C.B., Vacuum & Gas C.B.

Types of Lightning Arrester - Horn-gap Arrester, Thyrite Arrester, Valve type Arrester & Pellet type Oxide film Arrester.

Types of Insulators: Pin insulator, Strain insulator & Suspension type insulator.

#### 6. Battery:-

Primary & Secondary Cells, Construction & Characteristic of Lead acid Cell, Chemical changes, Application & Maintenance of Lead acid Cell & Charging systems ( constant current & constant Voltage)

#### 7. Electrical Machines :

**D.C. Generator:-** Construction and different types of generator, E.M.F. Equation, Armature reaction, Commutation, General characteristics and related problems.

**D.C. Motor:-** Significance of back e.m.f., Derivation of Torque equation, Characteristics of different types of D.C. motors (Series, Shunt & Compound motor), Speed control of D.C. motor (Series & Shunt), Losses & Efficiency and related problems.

**8. DIGITAL FUNDAMENTALS:**

**Number system and codes:** Binary Number System, Octal Number System, Decimal Number System, Hexadecimal Number System, Conversion of number systems. ASCII Code, Excess-3 Code, Gray Code, EBCDIC code.

**Digital Logic:** Basic Gates, Boolean algebra, Combinational and Universal Gates, Positive and Negative logic.

**Combinational Logic Circuits:** Boolean Laws and theorems, De-Morgans Theorem, Sum of products (SOP) and Product of sums (POS), Pairs, Quads, Octets, K-Map.

**Data Processing Circuits:** Multiplexers and De-Multiplexers, Encoder and Decoders, Parity generators and checkers, Programmable Logic Arrays, Programmable Array Logic.

**Arithmetic Circuits:** Binary addition and subtraction, Signed and un-signed magnitude numbers, 1's and 2's complement, 9's and 10's complement, Adder and subtractor circuits.

**Flip Flops:** RS, JK, Gated, Edge triggered flip-flops, JK Master-Slave flip-flop.

**Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel Out, Ring Counters.

**Counters:** Asynchronous and Synchronous counters, Decade counters, Modulus counters

**Memory:** Basic terms and concepts, Magnetic and semiconductor memories, Memory addressing.

ELECTRICAL ENGINEERING  
Paper - 2

For both objective and conventional type:

page 1

**1. Electrical Machines**

**Transformer:-** Construction of different types of transformers, e.m.f. Equation, Equivalent circuit, Vector diagrams on No load & load condition, Short circuit & Open circuit test, Losses & Efficiency, Auto-transformer, Different connections of 3 phase Transformer like star-star, delta-delta, delta-star & star-delta & related problems.

**Synchronous Motor:-** Principle of operation, Starting methods, effects of excitation on armature current & power factor, Construction of V-curve & inverted V-curve, Vector diagram and related problems.

**3-phase Induction motor:-** Descriptions of its component, Relation between supply frequency, slip & rotor frequency, Torque equation, condition of maximum torque, Power stages, Starting & Speed control and related problems.

**1-phase motor:-**

Single phase Induction motor:- Different types, starting method, double field revolving theory.

Shaded pole motor, Universal motor, Repulsion motor & A.C. Series motor.

**Alternator Or AC Generator:-**

Construction, Pitch factor, Breadth factor, Equation of induced emf, leakage reactance, Synchronous reactance, Vector diagram, Voltage regulation & its determination by Synchronous impedance method and related problems.

## 2. Power System:-

**Power Generating Stations:-** Hydro, Thermal & Nuclear

**Tariff :-** Tariff & Economic consideration, operating factors, Power factor improvements & Related problems.

**Transmission Lines:-** Transmission line (Short, Medium & Long), Voltage regulation & Transmission efficiency and related problems

**Distribution Lines:-** Types of distributors ( radial & ring main), Inter connected system and related problems.

## 3. Sub-Station:-

Different types & Components of Sub-station, Bus-bar arrangement, Types & laying method of Underground Cables and Types of Earthing.

4. **Control System:** Mathematical modeling of physical system Block diagrams - open and closed loop control system & their reduction,

## 5. ELECTRONIC DEVICES AND CIRCUITS :

**Fundamental of Electronics:** Definition and field of application of electronics. Types of electronic components – active, passive, symbols, colour codes and uses.

**Basic semiconductor Theory:** Atomic structure, valency and energy levels, energy band diagrams of insulators, conductors and semiconductors. Definition and types of semiconductors. Doping, Intrinsic and extrinsic semiconductors, P and N type semiconductors.

**PN Junction Theory:** PN Junction diode, Formation of electrons and holes and the effect of temperature, forward and reverse bias, volt ampere characteristics, LED, Photodiode, Zener diode and their applications.

**Rectifiers and filters:** Rectifier circuits - Half wave, full wave, center tapped and bridge rectifiers, Simple filter circuits – C, LC and CLC.

**Junction transistors:** Junction transistor construction, types, symbols, principle of operation and field of applications, Biasing transistor in active, saturation and cut-off region, Fixed bias and potential divider, Types of configuration – CB, CE and CC, their input and output characteristics, Current amplification factors – alpha, beta and relationship between them.

**Transistor Amplifiers :** Basic CB, CE amplifiers - graphical analysis and load lines, RC coupled amplifier - frequency response, upper and lower cut-off and bandwidth, Multistage Amplifiers - Class A, B, AB and C tuned voltage amplifiers.

**Feedback Amplifiers and Oscillators:** Principle of feedback and types of feedback, Barkhausen Criterion, RC phase shift, Wienbridge, Hartley, Colpitt and Crystal oscillators.

**Special electronic devices:** Construction symbols and characteristics of JFET, MOSFET, UJT, DIAC, TRIAC and SCR.

**Operational Amplifiers (OPAMP – 741C):** Differential amplifier, Differentiator, Integrator, Characteristics of OPAMP.

**IC 555 Timer Counter:** Multivibrators – Astable, Monostable and Bi-stable.

## 6. MICROPROCESSOR AND ITS APPLICATIONS:

**Introduction:** Evolution of microprocessor, evolution of microcomputer, Components of a computer (digital), Buses and memory addressing capacity of CPU.

**Microprocessor Architecture of 8085 :** ALU, Timing and control unit, Registers, Address and data buses, Pin configuration, Opcode and operand, instruction cycle, instruction and data flow, Timing diagram.

**Instruction Set for 8085:** Instruction and data formats, Addressing modes, Status flags, Instructions and types, Various languages, Stack and subroutines, Programs.

**Peripheral Devices and their interfacing:** Address space partitioning, Memory and input output interfacing, Data transfer schemes, Interrupts of 8085, Interfacing devices and input output devices, Programmable peripherals interface (8255), 8253, 8257, 8279.