

# NE02: JE Electrical/Electrical & Electronics

## Basic Electrical Engg. And Electt. Measurements:

Concepts of currents, Voltage, Resistance, Power and energy, their units, Ohm's law. Circuit Law: Kirchhoff's law  
Solution of simple network problems, Network theorems and their applications, Electro-magnetism concept of flux, Emf, Reluctance, Magnetic circuits, Electro-magnetic induction, Self and mutual inductance. A.C. fundamentals  
Instantaneous, Peak, R.m.s. And average values of alternating waves, Equation of sinusoidal wave form, Simple series and parallel a.c. Circuits consisting of R.L. and C. Resonance, Measurement and measuring instruments  
Moving coil and moving iron ammeters and voltmeters, Extension of range, Watt meters, Multimeters, Megger, Basic Electronics.

## Electrical machines:

Basic principles D, C motors of generators, their characteristics, Speed control and starting of D.C. motors, Losses and efficiency of D.C. machines.

## 1-phase and 3-phase Transformers:

Principles of Operation, Equivalent Circuit, Voltage Regulation O.C. And S.C. Tests, Efficiency, Auto Transformers, Synchronous Machines, Generation Of Three Phase Emf, Armature Reaction, Voltage Regulation, Parallel Operation Of Two Alternators, Synchronizing, Starting And Applications Of Synchronous Motors, 3-Phase Induction Motor, Rotating Magnetic Field, Principle Of Operation, Equivalent Circuit, Torque Speed Characteristics, Starting And Speed Control Of 3-Phase Induction Motors, Fractional Kw Motors, 1-Phase Induction Motors A.C. Series Motor, Reluctance Motor.

## General, Transmission and Distribution:

Different types of power stations, Load factor, Diversity factor, Demand factor, Simple problems thereon, Cost of generation inter connection of power stations, Power factor improvement, Various types of tariffs, Types of faults  
Short circuit current for symmetrical faults, Switchgears-rating of circuit breakers: Principles of a are extinction by oil and air, H.R.C. fuses, Protection earthier leakage, Over current Buchhotgz relayMerz-Prince system of protection of generators & transformers, Protection of feeders and bus bars., Lightning arresters, Various transmission and distribution systems, Comparison of conductor materials. Efficiency for different systems.

## Utilization of Electrical Energy:

Illumination, Electric heating, Electric welding, Electroplating, Electric drivers and motors.

## BASIC ELECTRICAL ENGINEERING

Basic concepts and principles of D.C and A.C fundamental, A C circuits, batteries, electromagnetic induction etc. including constant voltage and current sources.

## ANALOG ELECTRONICS

Fundamental concepts of basic electronics and basic understanding of conductors, semiconductors and insulators, extrinsic and intrinsic semi-conductors, p-n junction, need of rectifiers in electronics, understanding of filters in rectifiers, tunnel diodes, LEDs, varactor diodes, LCD; working of transistors in various configurations; Concept of FETs and MOSFET etc.

## CONTROL SYSTEMS

Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, basic elements of a servo mechanism, Examples of automatic control systems, use of equivalent systems for system analysis, linear systems, non-linear systems, control system examples from chemical systems, mechanical systems, electrical systems, introduction to Laplace transform.

Transfer function analysis of ac and dc servomotors synchros, stepper motor, amply dyne. ac position control system, magnetic amplifier.

Control system representation: Transfer function, block diagram, reduction of block diagram, problems on block diagram, Mason's formula signal flow graph

Non-Linear Control System : Introduction, behaviour of non-linear control system, Different types of nonlinearities, saturation, backlash, hysteresis, dead zone, relay, fiction, characteristics of non-linear control system, limit cycles, jump resonance, jump phenomenon. Difference between linear and non-linear control system.

## ELECTRONIC COMPONENTS AND MATERIALS

Materials :

Classification of materials , Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure.

Conducting Materials : Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing. Classification of conducting materials into low resistivity and high resistivity materials.

Insulating Materials : Important relevant characteristics (electrical, mechanical and thermal) and applications of the following material: Mica, Glass, Copper, Silver, PVC, Silicon, Rubber, Bakelite, Cotton, Ceramic, Polyester, Polythene and Varnish.

Magnetic Materials : Different Magnetic materials; (Dia, Para, Ferro) and their properties. Ferro magnetism, Domains, permeability, Hysteresis loop. Soft and hard magnetic materials, their examples and typical applications.

## MEASURING INSTRUMENTS

Introduction to Testing and Measurements, Measurement of Resistance, Inductance and Capacitance, Ammeter, Voltmeter and Multimeter, Power and Energy Measurements, Frequency and Phase difference Measurement.

## PRINCIPLES OF INSTRUMENTATION

Basic building blocks of any instrumentation systems, Performance characteristics of Oscillator Instruments, Instrument selection: Factors affecting instrument selection, accuracy, precision, linearity, resolution, sensitivity, hysteresis, reliability, serviceability, loading effect, range advantage and limitation, cost effectiveness and availability  
- Static and dynamic response - Environmental effects - Calibration tools

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## **FUNDAMENTALS OF DIGITAL ELECTRONICS**

Concepts of Digital electronics, Number system , gates, codes, arithmetic logic circuits, flip-flops, shift registers and counters.

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