

**FURTHER DETAILS REGARDING MAIN TOPICS OF  
PROGRAMME NO.04/2010**

**ASSISTANT ENGINEER (ELECTRICAL)**

**CATEGORY NO. 215/2009**

**Electrical Science - General Principles**

SI units, Electric Charge, Coulombs law, Electric Current. Ohm's law, Krichoff's law, Faraday's laws of electromagnetic induction.

Basic Circuit Elements : Ideal independent current and voltage sources, Energy and Power, R,L and C parameters.

Basic circuit analysis (for Resistive circuits excited by independent sources) Using KCL and KVL, Mesh Current Analysis.

Newtork Transformations and theorems: (for Resistive Circuits, excited indepentent Sources.) Series parallel equivalents, Star- Delta equivalents, super position theorem, Thevenin's and Norton's theorems, maximum Power transfer theorem.

Sinusoidal steady state analysis: Sinusoidal functions ,Average and effective values of periodic functions, instantaneous and average power, power factor, Phasor representation of sinusoids, Response of single elements (R-L-C) for sinusoidal excitation , phaser concept and phaser diagrams, impedance and admittance concept.

Power in AC Circuits -Introduction to 3-phase system, Balanced 3-phase system. Measurement of power using two watt meters and measurement of reactive power.

**Electrical Machines**

Principles of electro mechanical energy conversion. Basic concepts of rotating machines, DC Machines, performance characteristics, speed control, testing and efficiency. Transformers – regulation and efficiency, parallel operation phase conversion- Autotransformers.

Induction machines- performance-time and space Harmonics - starting and speed control and testing. Synchronous machines- generators and motors- salient pole synchronous machines- characteristics-regulation- parallel operation-operation on infinit bus

**Electric Energy Systems**

Methods of electric power generation -transmission line parameters- short, medium and long lines characteristics and performances. cables .construction and characteristics .Insulators. String efficiency. Basic principles of protection .circuit Breakers.

Percentage and per unit analysis of symmetrical three phase systems- network modelling, bus admittance matrix and bus impedance matrix, load flow analysis- N.R Method, gauss-siedel method -fault analysis, power systems stability, swing equation.

## **Electrical Measurement and Instruments**

Quality of measurements-Analog instruments. Basic movements, Taut-band, electro dynamometer and moving iron types. Ammeters and voltmeters: Calibration and extension of range, Rectifier type meters, average, peak and true RMS responding voltmeters, wattmeters, Energy meters and powerfactor meters. .Digital multimeter and data acquisition systems.

## **Power Electronics**

Power semiconductor devices: Characteristics of power diodes, SCR, BJT, Power Mos FET, triac, GTO and IGBT.

Phase controlled converters: Single Phase-Semi and Full converters, Three Phase Semi converters and Full converters, Dual converters, Power factor improvements in converters. Effects of load and source inductance gating and protection circuits. Principle of cyclo converters, AC voltage controller: on -off control and phase control. single phase-full wave controller, PWM controller.

DC choppers: Step down and Step up choppers, Two quadrant and four quadrant choppers, switching mode regulators.

Invertors: Principle of operation -performance parameters, single phase and 3-phase bridge invertors.

## **Control System**

Transfer function-block diagrams-signal flow graph- feed back characteristics of Control systems. Time response of first and second order systems-steady state error and error constants. Concept of stability, Hurwitz stability criterion. Routh stability critrion, Root locus analysis -construction of roots locus- sensitivity of roots of characteristic equation. Frequency response analysis correlation between time and frequency response- polar-plots, Bode plots -Nyquist stability criterion -closed loop frequency response-Nichols chart, state variable analysis -models-solutions of state equations- controllability, observability and pole placement.

**NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.**