Annexure "E"

SYLLABUS FOR THE POST OF JUNIOR ENGINEER (ELECTRICAL)

Total Marks:120 **Time: 02 Hours**

1. Electric Circuits and Fields: **15 Marks**

Basic concepts: Concepts of resistance, inductance, capacitance and various factors effecting them., Circuit laws: ohms law KCL, KVL, node and mesh analysis, resonance, ideal current and voltage sources, Source conversions Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, Simple Circuit solution using network theorems. Three phase circuits; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

2. Control Systems: **10 Marks**

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems.

3. Electrical and Electronic Measurements: **15 Marks**

Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; Extension of range, measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes. Transducers: measurement of displacement, flow and temperature, Megger. Measurements of active and reactive power, Measurement of Energy.

4. Electronic Devices and Circuits: **10 Marks**

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, avalanche photo diode .Small Signal Equivalent circuits of diodes, BJTs, MOSFETs. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Single-and multi-stage, tuned voltage, operational, feedback, and power amplifiers. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers IC and its applications. Power supplies.

5. Digital Electronics and Microprocessor: **10 Marks**

Number systems: Binary, decimal, octal, hexadecimal, BCD number systems and their conversions, Binary and hexadecimal addition, subtraction multiplication,1's and 2's complement methods of addition/subtraction. Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs. Sequential circuits: latches and flip-flops, counters and shift-registers. ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, instruction set, programming, memory and I/O interfacing. Study of peripheral chips-8251,8155, 8257,8259.

6. Power Electronics and Drives: **10 Marks**

Semiconductor power diodes, transistors, thyristors, triacs and MOSFETs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; Choppers and Inverters; concepts of adjustable speed dc and ac drives.

7. Electrical Machines: **25 Marks**

Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; autotransformer, Energy conversion principles, Electro-mechanical energy conversion ; DC machines–types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors– principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors. Braking of DC and AC motors

8. Power Systems: **25 Marks**

Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; power factor correction; economic operation; symmetrical components; principles of over-current, differential and distance protection; Generator, feeder, transformer and bus-bar protection, Lightning protection; solid state relays and circuit breakers; Sub-Station Practices, Load frequency control, Tariffs, Earthing. Utilisation of Electrical energy: Illumination, electrical heating and welding, electroplating.

****