

TAMIL NADU PUBLIC SERVICE COMMISSION

POST OF PRINCIPAL / ASSISTANT DIRECTOR (TRAINING)

INCLUDED IN THE TAMIL NADU EMPLOYMENT AND TRAINING SERVICES

ELECTRICAL & ELECTRONICS ENGINEERING (DEGREE STANDARD)

UNIT I Electrical Circuits and Analysis

Ohm's Law – Kirchoff's laws – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power - Power Factor and Energy - A.C networks - sinusoidal steady-state analysis - resonance in electrical circuits - concepts of ideal voltage and current sources - network theorems - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters - Three phase circuits balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads - balanced & unbalanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

UNIT II Electromagnetic Fields

Electric potential – Electric field in free space, conductors - dielectrics - Dielectric polarization - Dielectric strength - Electric Boundary conditions Poisson's and Laplace's equations, Capacitance, Energy density - Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic force, Torque, Inductance, Energy density - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form)-magnetic circuits - Electromagnetic wave generation and equations – Wave parameters - velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector.

UNIT III Electrical Machines

Single phase transformer - equivalent circuit, phasor diagram, OC & SC tests, regulation and efficiency - three phase transformer-connections - auto transformer; principles of energy conversion, windings of rotating machines Principle and operations Types and Design of DC,AC Motors & Generators – Speed Torque Characteristics -starting and speed control, armature reaction and commutation –Plugging, dynamic and regenerative braking- testing and efficiency - three phase induction motors-performance characteristics, starting and speed control - single-phase induction motors - synchronous generators - performance, regulation - synchronous motors-starting characteristics, applications, synchronous condensers - fractional horse power motors - permanent magnet and stepper motors.

UNIT IV Power Systems

Electric power generation – thermal, hydro, nuclear; transmission line parameters - steady-state performance of overhead transmission lines and cables and surge propagation - distribution system, insulators, bundle conductors, corona and radio interferences effects - per-unit quantities - bus admittance and impedance matrices - load flow - voltage control and power factor correction - economic operation - symmetrical components, analysis of symmetrical and unsymmetrical faults - principles of system stability - swing curves and equal area criterion.

UNIT V Protection And Switchgear

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages, Corona and its effects – Reflection and Refraction of Travelling waves - Protection against overvoltages - Principles and need for protective schemes – Methods of Neutral grounding – Insulation Coordination - Operating principles, construction & types of Electromagnetic Relays - the Universal relay – Torque equation – R-X diagram –Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays, Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators - Apparatus protection - Current transformers and Potential transformers and their applications in protection schemes - Overcurrent protection, transformer differential protection, distant protection of transmission lines - Circuit breakers - Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

UNIT VI Control & Instrumentation

Principles of feedback - transfer function - block diagram - steady-state errors – stability - Routh and Nyquist criteria - Bode plots – compensation - root loci - elementary state variable formulation - state transition matrix and response for Linear time Invariant systems - Measurement of R, L and C-Bridges, potentiometers & galvanometers - Measurement of voltage, current, power, power factor and energy- Instrument transformers, Q meter, Waveform Analysers – Digital voltmeter, multimeter - Time, phase and frequency measurements – Elements of data acquisition system – A/D, D/A converters – Oscilloscope – display and recording devices – Noise and interference in Instrumentation.

UNIT VII Power Electronics and Drives

Semiconductor power devices-diodes – transistors – thyristors – triacs – GTO - MOSFETs and IGBTs - static characteristic and principles of operation - triggering circuits - phase control rectifiers - bridge converters - fully controlled and half controlled - principles of choppers and inverters - basic concepts of adjustable speed dc and ac drives.

UNIT VIII Digital Electronics

Digital Logic Theory - Number systems - Combinational logic circuits - Minimisation of Boolean functions-IC families-Arithmetic circuit - Multiplexer - decoders-Sequential circuits-Flip flops – counters - shift registers - Schmitt trigger - timers and multivibrators - Microprocessor - General 8 bit microprocessor Architecture-8085, 8086 processor – Architecture, Memory, I/O interfacing, Instruction set, Addressing modes, Timing diagram & delays, Machine cycles, Interrupts, counters, Assembly language programming – Microcontrollers - 8 bit microcontroller – 8051 architecture, bus configuration, Instruction sets, programming & Applications.

UNIT IX Communication Engineering

Modulation and demodulation systems – Types of transmission lines – losses – standing waves – Ground wave and space wave propagation – Digital communication concepts – Data Communication codes - serial and parallel interface – Network protocol – Types of satellites – Advantages of optical fibre communication.

UNIT X Computer Systems & Programming

Abstract Data Types (ADT) - Stack ADT – Queue ADT – circular queue implementation – TREE STRUCTURES – Tree ADT – tree traversals – Binary Search Tree ADT – expression trees – AVL trees – Binary Heaps – B-Tree – Hashing – Separate chaining – open addressing – Linear probing Graphs Definitions – Topological sort – Algorithm Design And Analysis-Greedy algorithms – Randomized algorithms – algorithm analysis - Object oriented programming concepts - Operator overloading- Exception handling - Introduction to JAVA bytecode - virtual machines – objects – classes – Javadoc – packages – Arrays – Strings - Inheritance – interfaces and inner classes - exception handling – threads - Streams and I/O - operating system structures – system calls – system programs - Process concept – Process scheduling and Synchronisation – Storage Management and File Systems - Input/output device Interface.