Tamil Nadu Public Service Commission
Syllabus
Electrical, Electronics and Communication Engineering
(Degree Standard)

Code: 514

Unit I: Circuit Theory, Signals and Systems (20 Questions)

Circuit analysis: Kirchoff's laws, Nodal and Mesh analysis, Network Theorems: Superposition, Thevenin, Norton, Miller and Reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, Star-Delta transformation. Three Phase Circuits – Star-delta transformation - Real and reactive power – power factor - Characteristics and classifications of Continuous and Discrete Time signals - CT signal analysis - Fourier Series, Fourier Transform and Laplace Transform. Sampling theorem, Discrete Time signal analysis - DTFT and Z-Transform. CT and DT systems - Impulse response and convolution, Frequency response, Transform domain analysis using FT, LT - Recursive and non-recursive systems.

Unit II: Analog and Digital Electronics (20 Questions)

Semiconductor Devices: PN Diode, Zener, LED, Photo diodes, Transistors, FET and their applications. Rectifier circuits, Voltage regulators, Biasing circuits, Small signal amplifiers, Frequency response, Multistage amplifiers, Coupling methods, Large signal amplifiers, Push, pull amplifiers, Feedback amplifiers, Oscillators, Operational amplifiers and its applications, Precision rectifiers, Multivibrators, Schmitt triggers, Voltage Controlled Oscillator, 555 Timer.

Number representations: Binary, Integer and Floating point numbers, Boolean algebra, Minimization of functions using Boolean identities and Karnaugh map. Digital logic gate families (DTL,TTL,ECL,MOS,CMOS), Logic gates, Simplification of Logic Functions, Design of Combinational circuits, Sequential logic circuits, latch, Flipflops, Counters, Registers, multiplexers and demultiplexers, Memories(ROM,PLA and FPGA).

Unit III: Electromagnetic Theory (20 Questions)

Coulomb's Law-Electric Field Intensity-Electric Flux Density-Gauss's Law - Divergence - Electric Field and Potential due to Point, Line, Plane and Spherical Charge Distributions - Effect of Dielectric Medium - Capacitance of Simple Configurations- Magnetic Circuits- Magnetomotive force - Reluctance-Faraday's laws-Lenz's law-Biot-Savart's law - Ampere's law - Fleming's Left and Right Hand Rule-Lorentz force - Inductance - Self and Mutual Inductance-Dot Convention-Coupled Circuits

Maxwell's equations, Poynting vector. Plane waves and properties: Reflection and refraction, Polarization, Phase and group velocity, Propagation through various media, Skin depth. Transmission lines: Equations, Characteristic impedance, Impedance matching, Impedance transformation.

Unit IV: Electrical Machines (20 Questions)

D.C. Machines - Construction, Excitation methods - Armature Reaction and Commutation - Characteristics and Performance Analysis - Generators and Motors - Starting, Speed Control and braking - Testing - Losses and Efficiency. Transformers – Types - Construction and Operation – Testing - Equivalent Circuits - Losses and Efficiency - All day efficiency - Regulation - Parallel Operation - Three Phase Transformers - Auto-transformer. Induction Machines - Construction, Principle of operation - Rotating Magnetic Field - Performance, Torque-Speed Characteristics, No-load and Blocked Rotor tests, Equivalent Circuit, - Starting, Speed Control and braking. Single Phase Induction Motors - Linear Induction Motors - Hysteresis Motors - Reluctance Motors.

Synchronous Machines – Construction - Operating characteristics and Performance analysis - Efficiency and Voltage regulation - Parallel operation - V and inverted V curves of synchronous motors - Power factor improvement - permanent magnet synchronous motor - Permanent magnet brushless dc motor - stepper motor.

Unit V: Control Systems (20 Questions)

Mathematical Modelling of Physical Systems - Transfer Function - Block Diagrams and Signal Flow Graphs and their Reduction using Mason's Rule - Time Domain and Frequency Domain Analysis of Linear Time Invariant (LTI) System - Errors for Different Type of Inputs and Stability Criteria for Feedback Systems - Stability Analysis Using Routh-Hurwitz Array - Nyquist Plot and Bode Plot - Root Locus - Gain and Phase Margin - Basic Concepts of Compensator Design - PI, PD and PID Controllers - State Variable formulation - state transition matrix - Eigen values and Eigen vectors - free and forced responses of Time Invariant systems - controllability and observability.

Unit VI: Power Systems (20 Questions)

Single Line Diagram of Power System - Per Unit Quantities - Power Generation Types - Hydro, Thermal and Nuclear Stations - Pumped storage plants - Cogeneration - Economic and operating factors - Modelling and performance characteristics of Power transmission lines and Cables - Mechanical Design of Transmission Lines – Sag - Insulators -Z_{Bus} and Y_{Bus} formulation - Load flow studies - Shunt and Series Compensation - Symmetrical and Unsymmetrical Fault Analysis - Transient and Steady - State Stability of Power Systems - Equal Area Criterion - Voltage and Frequency Control-Power System Transients - Power System Protection - Circuit Breakers - Relays classification of protection schemes -overcurrent, distance, differential and carrier - Equipment protection - transformer, generator, motor, busbars and transmission line – earthing and lightning protection - AC and DC Distribution – deregulation - energy conservation and energy auditing

Unit VII: Measurements and Instrumentation (20 Questions)

Units and Standards - Static and Dynamic Characteristics - Types of Errors - Error Analysis - Measurement of Current, Voltage, Power, Power-factor and Energy - Indicating instruments - Measurement of Resistance, Inductance, Capacitance and Frequency - Bridge Measurements - Instrument Transformers - Electronic Measuring Instruments - Multi meters - True RMS meter - Spectrum Analyzer -Power Quality Analyser - Recording Instruments-X-Y Recorder - Magnetic Recorders - Digital Data Recorder – Oscilloscopes – DSO - LED and LCD Display –Sensors and Transducers and their applications to the Measurement of Non-Electrical Quantities like Temperature Pressure, Flow-rate, Displacement, Acceleration, Noise level, Fire and smoke deduction - Data Acquisition Systems – A/D and D/A Converters - Data Transmission Systems - PLC -smart meters.

Unit VIII: Digital Processors, Communication and Networks (20 Questions)

Architecture of 8085, 8086 and 8051 – Instruction Sets – Assembly Language Programming – Interfacing for memory and I/O: 8255 Programmable Peripheral Interface – 8253 Programmable Timer Interface – 8279 Programmable Keyboard and Display Interface – 8257 Direct Memory Access Interface - Embedded processors (ARM and PIC basics only). Classification of Signals and systems – Properties of Discrete Fourier Transforms - FFT Computation – FIR Filters – IIR Filters: Butterworth Filters – Chebyshev Filters.

Analog and Digital Communication Systems: AM/FM Modulation and Demodulation, ASK, FSK, PSK, PCM – Adaptive Delta Modulation – FDM and TDM –OSI MODEL, TCP/IP reference model, Data link layer, Medium Access Control, Network layer.

Unit IX: Power Electronics and Drives (20 Questions)

Static and dynamic behaviour of Power Semiconductor devices - Power Diode, DIAC, SCR, TRIAC, GTO, MOSFET and IGBT - Single and Three Phase AC to DC Converters - uncontrolled and controlled rectifiers - performance parameters - Switched Mode Power Supplies - buck, boost and buck-boost converter topologies - Switching losses – Inverters - Single and Three Phase Inverters - Voltage control - Pulse Width Modulation techniques - harmonic elimination techniques – AC voltage controllers- Uninterrupted Power Supplies - Electrical drives - motor load dynamics - load torque characteristics - Speed Control of DC Drives - Converter/Chopper fed dc motor drives - Speed control of AC drives - induction motor drives - stator voltage control and V/f control - synchronous motor drives -V/f control, self control, margin angle control and power factor control

Unit X: Renewable Energy Sources, Storage Devices and Utilisation Of Electrical Energy (20 Questions)

Renewable Energy – Sources and Features - Solar Radiation Spectrum - Radiation Measurement - Solar Photovoltaic Cell – principle of operation – types - MPPT – Microhydel - Operating principle - Wind Energy – components - wind power turbine types - MPPT- Site Selection - Types of Wind Generators - smart grid - Electric vehicles - V2G and G2V - Fuel Cells - Batteries - types and characteristics - Super Capacitors.

Electrical wiring – illumination - design of lighting schemes - Air conditioning system.

Note: The medium of instruction is only in English.

Dated: 20.02.2025