

TAMILNADU PUBLIC SERVICE COMMISSION
SYLLABUS
ELECTRICAL AND ELECTRONICS ENGINEERING
(DEGREE STANDARD)

CODE: 400

UNIT I: ELECTRICAL CIRCUITS (25 Questions)

Circuit elements – Kirchoff’s Laws – Mesh and Nodal Analysis – Network Theorems and Applications for DC and AC circuits: Thevenin’s Theorem, Norton’s Theorem, Superposition Theorem, Maximum Power Transfer Theorem – Sinusoidal Steady State Analysis of RL-RC-RLC Circuits - Resonant Circuits –Natural and Forced Response – Transient Response of RL-RC-RLC Circuits – Two – port networks – Three Phase Circuits – Star - delta transformation – real and reactive power – power factor

UNIT II: ELECTRIC AND MAGNETIC FIELDS (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 – Magneto motive 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

UNIT III: 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 – Transducers and their applications to the Measurement of Non –Electrical Quantities like Temperature, Pressure, Flow-rate, Displacement, Acceleration, Noise level – Data Acquisition Systems – A/D and D/A Converters –Data Transmission Systems – PLC – smart meters

UNIT IV: CONTROL SYSTEMS (15 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 V: ELECTRICAL MACHINES (25 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 VI: POWER SYSTEMS (30 Questions)

Single Line Diagram of Power System – Per Unit Quantities –Power Generation Types - Hydro, Thermal and Nuclear Stations – Pumped storage plants –Co generation – Economic and operating factors – Modelling and performance characteristics of Power transmission lines and Cables - HVDC transmission – Mechanical Design of Transmission Lines - Sag – Insulators - Z_{Bus} and Y_{Bus} formulation – Load flow studies – Shunt and Series Compensation –Symmetrical and Unsymmetrical Faults 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 – AC and DC Distribution – deregulation –energy conservation and energy auditing

UNIT VII: ANALOG AND DIGITAL ELECTRONICS (15 Questions)

Semiconductor Devices – PN junctions – Transistors – FET – Zener, Photo diodes and their applications – Rectifier circuits – Voltage regulators – Multipliers. Biasing circuits – Small signal amplifiers – Frequency response – Multi stage amplifiers – Coupling methods – Large signal amplifiers – Push-pull amplifiers – Feedback amplifiers – Oscillators – Operational amplifiers and its applications – Precision rectifiers – Multi vibrators – Voltage Controlled Oscillator – Timer. 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 – Schmitt triggers – Memories (ROM,PLA and FPGA).

UNIT VIII: POWER ELECTRONICS AND DRIVES (15 Questions)

Principle of Operation and Static and dynamic behavior of Power Semi conductor devices – Power Diode, DIAC, SCR, TRIAC, GTO, MOSFET and IGBT – Single and Three Phase AC to DC Converters – uncontrolled and controlled rectifiers – performance parameters – Single and Three Phase AC to AC converters – 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 – Uninterrupted Power Supplies – Electrical drives – motor load dynamics – load torque characteristics – Speed Control of DCD rives – 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 IX: DIGITAL PROCESSORS AND COMMUNICATION (10 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– IIRFilters: Butterworth Filters – Chebyshev Filters.

Digital Communication Systems: Pulse Code Modulation and Demodulation – Adaptive Delta Modulation – Frequency Division and Time Division Multiplexing – Data Communication Network Topologies -7-layer OSI Protocol - IoT concepts

**UNIT X: RENEWABLE ENERGY SOURCES AND STORAGE DEVICES
(25 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.