

**Tamil Nadu Public Service Commission**  
**Syllabus**  
**Electronics and Instrumentation Engineering**  
**(Degree Standard)**

**Code: 402**

**Unit I: Analog Electronics (20 Questions)**

Characteristics and Applications of Diode, BJT, JFET, SCR, UJT, MOSFET – Small Signal Analysis of BJT and JFET amplifiers, Feedback Amplifiers, RC and LC Oscillators – Characteristics and Applications of Operational Amplifier, Differentiator, Integrator, Instrumentation Amplifier, Precision Rectifier, V to I and I to V Converter, Active Filters, Oscillators and Signal Generators.

**Unit II: Digital Electronics (20 Questions)**

**Digital Logic Theory:**

Number Systems – Combinational Logic Circuits – Minimization of Boolean Functions – IC Families: TTL and CMOS – Arithmetic Circuits, Multiplexer & Decoders – Sequential Circuits: Flipflops, Counters, Shift Registers, Schmitt Trigger, Timers, Multi vibrators, S/H Circuit – Analog to Digital Converter (Successive approximation, Integrating and Sigma Delta) – Digital to Analog Converters (Binary Weighted Resistor, R-2R, Inverted R-2R) – Characteristics of ADC and DAC.

**Embedded Systems:**

Microprocessor and Micro controller Applications, RISC and CISC Processors, Memory and Input – Output Interfacing, Embedded C Programming, Multiprocessors, Scheduling, Power Optimization Strategies, I<sup>2</sup>C and CAN Buses.

**Unit III: Digital Signal Processing and Communication Engineering**

**(20 Questions)**

**Discrete Time Signals and Systems:**

Sampling Theorem, Characteristics and Classifications of DT Signals and Systems – LTI System Characteristics, Convolution and Correlation, Time Domain and Frequency Domain Analysis – ZT, DTFT, DFT – FFT Algorithms – IIR and FIR Filters.

**Communication Engineering:**

Amplitude and Frequency Modulation and Demodulation – Shannon's Sampling Theorem, Pulse Code Modulation, Frequency and Time Division Multiplexing. Digital Communication System (ASK, FSK, PSK and QAM) – Digital Communication Concepts – Network Protocols – ISO/OSI reference model – Fiber Optic Communication.

**Unit IV: Transducer Engineering (20 Questions)**

Units and Standards – Calibration Methods – Errors in Measurement and Uncertainty analysis – Static and Dynamic Characteristics of First and Second Order Transducers – Resistive, Capacitive, Inductive, Piezoelectric, Magnetostrictive, Hall Effect and Smart Sensors and Associated Signal Conditioning Circuits.

**Unit V: Electrical and Electronic Measurements (15 Questions)**

Measurement of Resistance, Capacitance, Inductance and Frequency using Bridges (Wheatstone, Kelvin, Megohm, Maxwell, Anderson, Schering and Wien Bridge) – Q-meter – Galvanometer, Measurement of Voltage and Current – Power and Energy Measurements – Potentiometers, and

Instrument Transformers – Digital Voltmeter, Digital Multimeter, Time, Phase and Frequency Measurements – Oscilloscopes – Digital and Recording Devices.

#### **Unit VI: Industrial Instrumentation (30 Questions)**

Measurement of Displacement (Linear and Angular), Force, Torque, Velocity, Acceleration, Vibration, Density, Viscosity, Humidity and Moisture, Measurement of Flow (Variable Head, Variable Area, Mass, Electromagnetic, Ultrasonic, Turbine and Open Channel Flow Meters) – Measurement of Level, pH, Temperature (Thermocouple, Bolometer, RTD, Thermistor, Pyrometer and Semiconductor) and Pressure – Universal Smart Transmitter.

#### **Unit VII: Analytical and Bio-Medical Instrumentation (15 Questions)**

**Analytical Instruments:** Spectrophotometers – Spectral Methods of Analysis – Source, Detectors and Applications – Ion Conductivity: Sampling System, Ion Selective Electrodes, Conductivity and pH meters – Gas Analyzers – Chromatography – NMR Spectroscopy – Mass Spectrometers – Dust and Smoke Measurements – Water Quality Analyzer. **Biomedical Instruments:** Bio-potentials and their Measurement Techniques & Signal Conditioning Circuits – ECG, EEG, EMG and ERG-Medical Imaging Systems: X-Ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Ultrasound.

#### **Unit VIII: Control Systems (20 Questions)**

Modeling of Mechanical and Electrical Systems (First Principle, Transfer Function and State Space Models) – Block Diagram Reduction – Signal Flow Graphs – Time and Frequency Domain Analysis – Stability Analysis (Root Locus, Routh Hurwitz Criterion, Nyquist Stability Criterion) – Lead/Lag Compensators – Controllability and Observability.

#### **Unit IX: Process Control (15 Questions)**

Process Modeling: Level and Thermal Processes – Interacting and Non-Interacting Systems – Self regulation – Degrees of freedom – Characteristics of ON/OFF, PID Control Modes – PID Controller Tuning (Z-N, Cohen-Coon and Continuous Cycling) – PID Implementation Issues (Bumpless Transfer and Anti-reset Windup) – Control Valve Characteristics and Sizing – Control Schemes: Cascade, Feed - Forward, Ratio, Adaptive, Internal Model Controller and Model Predictive Control.

#### **Unit X: PLC, SCADA AND DCS (25 Questions)**

**PLC:** Architecture, I/O Modules, Programming Languages (Ladder Logic, Instruction List and Functional Block Diagram) – Internet of Things.

**SCADA:** RTU, Master Station and Communication Architectures.

**DCS:** Architecture, Local Control Unit, Field Control Unit, Operator and Engineering Human Interface Station, Displays – HART and Field Bus Communication Protocols.

Dated : 07.06.2023