TAMIL NADU PUBLIC SERVICE COMMISSION

SYLLABUS

INSTRUMENTATION ENGINEERING

(DIPLOMA STANDARD)

CODE: 448

UNIT-I : BASICS OF INSTRUMENTATION

Fundamental of Instruments - Measurement, Instruments – Instrumentation System, Standards, Errors, Static analysis, Static Characteristics, Dynamic Characteristics – Electrical Transducers & mechanical Transducers – Sensors – Pressure, proximity, Displacement, Hall effect, optical sensors and Bio sensors.

UNIT-II : BASICS ELECTRICAL AND ELECTRONICS

DC Circuits - Voltage, current, Resistance, Resistance in series, Resistance in parallel, Power, Energy, Ohm's Law, Kirchhoff's Laws – Network theorems – AC Circuits – Transformers – D.C Generators – D.C Motors – Single phase induction motors and Stepper motor.

Semiconductors - PN junction Diode - Zener diode - Rectifiers - Half wave, full wave and Bridge rectifiers – Filters - Bipolar junction Transistors (BJT) - Biasing configuration - RC coupled amplifier - Field effect Transistors (FET) - Transistor oscillators - LDR, LED, LCD, Opto coupler, Solar cell, Photo diode, Photo transistor.

UNIT-III : ANALOG AND DIGITAL ELECTRONICS

Number system – Boolean algebra – De-Morgan's theorems – Logic gates – symbols and truth tables – Combinational Circuits – Half & Full adder, Half & Full Subtractor circuits, Encoder and decoder, Multiplexer, De-multiplexer, Parity checker and generator – Sequential Circuits – Flip flops, Counters, Shift registers.

Operational Amplifier – IC 741 – Basic linear Circuits - Op-amp applications – A/D converters and D/A converters – IC 555 timer & its applications.

UNIT-IV : MEASUREMENT OF PROCESS VARIABLES

Measurement of temperature – Mechanical methods, Electrical methods – High temperature measurements – Measurement of Pressure - Mechanical methods, Electrical methods – Pressure Calibration - Measurement of Flow - Mechanical methods & Electrical methods – Measurement of level, Humidity & moisture (Electrical methods only).

UNIT-V : MEASUREMENTS AND INSTRUMENTS

Measuring instruments – PMMC, MI instruments, Galvanometer, Ammeter, Voltmeter - Range extension of Ammeter and Voltmeter – Bridges – AC and DC Bridges - Digital Instruments – Digital Voltmeter, Digital Multimeter, Digital frequency meter, Digital Tachometer & Digital storage CRO.

CRO & CRO probes, Applications of CRO – Function Generator. Types of recorder - Potential transformer & Current transformer - Fixed & Variable power supply.

UNIT-VI : PROCESS CONTROL INSTRUMENTATION

Process types, Variables, Automatic process control system, Set point, Error, Self regulation - Controller modes - electronic controller & Pneumatic controller, Tuning of controller – Types, Criteria, Methods of Open & closed loop response - Signal convertors – Actuators - control valve characteristic, Types of control valve ,Effects – methods of complex control system – Feed back, Feed forward, Ratio, Cascade, Direct digital control system, Computer control system and Distributer control system – Introduction of P & ID diagrams.

UNIT-VII : CONTROL SYSTEM

Basics of control system, Laplace transform, Transfer function, Rules for Block diagram reduction, Signal flow graph – Time response – Standard Test signals – Types of system – I order system, II order system (Undamped & Critical damped) – Steady state error, Static error constants, Frequency response of Linear system – Frequency Domain specifications (Definitions only) – Stability - Absolute stability and relative stability.

UNIT-VIII : INDUSTRIAL POWER ELECTRONS

Thyristor family – SCR, IGBT, MOSFET & GTO – Trigger circuits – Commutation (single phase & three phase) – Convertors – Choppers – Inverters – Application – SMPS, UPS – AC Voltage Regulators.

UNIT-IX : INDUSTRIAL AUTOMATION & DRIVES

Industrial drives – Electric drives – Stepper motor – Angle, Slewing rate, closed loop control of stepper motor - logic sequencer, optical encoder.

Servo motor –Speed control of induction motor.

Pneumatic & Hydraulic system – Elements, Power supplies & Accumulators – Types of Pneumatic filters, Regulators, Pressure control valves, valve symbols, Single acting & double acting cylinders - Hydraulic pumps , Air Compressors.

Robotics – anatomy, Classification of robots, robot drives & application of robots.

UNIT-X : BIO-MEDICAL INSTRUMENTATION

Bio-electric signals – resting & acting potential , types of electrodes.

Clinical Measurement – measurement of blood pressure, blood flow, respiration rate, lungs volume, heart rate, body & skin temperature.

Bio-medical recorders – ECG, EEG, EMG, ERG & audio meter.

Therapeutic instruments – pace makers – defibrillators, heart lung machine – dialysis & ventilator types.

Bio-telemetry system & its applications - Patient safety from electrical equipments – Methods of accident prevention .

Modern imaging techniques - Laser, X-ray, Ultrasonic, CT & MRI scanner imaging techniques.