

**DETAILED SYLLABUS FOR THE POST OF LECTURER IN
ELECTRONICS AND INSTRUMENTATION (POLYTECHNICS)
(TECHNICAL EDUCATION)**

(cat.No. :146/2022)

(Total Marks ±100)

Part- I (a): Technical Mathematics (10 Marks)

- I. Matrices ± Identification of Matrices, matrix operations, adjoint and inverse.
- II. Determinants ± Evaluation of second and third order, minors and cofactors, solutions of simultaneous linear equation in three unknown using Cramer's rule.
- III. Binomial Series ± Expansions using Binomial theorem.
- IV. Trigonometric functions ± Signs of functions in each quadrant. Trigonometric values of angles, properties of trigonometric functions, applications of the identities $\sin (A \pm B)$, $\cos (A \pm B)$ and $\tan (A \pm B)$.
- V. Coordinate geometry ± Equations to a straight line ± slope-intercept form, intercept form, Angle between two lines, condition for two lines to be perpendicular, parallel.
- VI. Differentiation ± Limits and continuity, derivatives of functions, equation to tangents and normals. Maxima and minima of functions of one variable.
- VII. Integration of functions ± Integration of different types of functions.
- VIII. Applications of integration ± Area bounded by a curve and X or Y axis, solutions of differential equations using the method of variable separable, solutions of linear differential equations of first order.

PART I (b): Basic Civil Engineering (5 Marks)

Materials: Brick ± varieties and strength, characteristics of good brick. Cement ± varieties and grade of cement and its uses. Steel ± types of steel for reinforcement bars, steel structural sections. Aggregates ± types & requirements of good aggregates. Concrete ± grades of concrete as per IS

code, water cement ratio. Workability, mixing, batching, compaction and curing.

Construction: Parts of building ± foundation ± types of foundations ± spread footing, isolated footing, combined footing, Raft, pile and well foundations. Masonry ± types rubble masonry, brick masonry, English bond and Flemish bond. (One brick wall).

Surveying: Chain surveying ± principles, instruments, ranging, and chaining survey lines, field work and field book, selection of survey stations, units of land area.

Levelling: Levelling instruments, different types, bench mark, reduced level of points, booking of field notes, reduction of levels by height of collimation method (simple problem). Modern survey ± instruments ± Total station, Electronics theodolite, Distomat.

PART I (c): Basic Mechanical Engineering (5 Marks)

The importance of IC Engines: Definition, classification ± two stroke engines, four stroke engines, working of two stroke engines and four stroke engines with the help of line sketches, comparison between two stroke and four stroke engines, comparison between petrol and diesel engines, function of fly wheel, clutch, gearbox, propeller shaft and differential in power transmission, explain with sketch the working of differential, briefly explain power transmission of 4 wheel vehicle with line diagram.

The importance of Power Plants: Introduction, classification of power plants ± working of hydroelectric power plant with schematic sketches ± working of thermal (Steam and Diesel) power plant with schematic sketches ± working of nuclear power plant with schematic sketches.

PART I (d): Basic Electrical Engineering (5 Marks)

Review with discussion of electric current, potential difference, power, EMF, resistance and its laws, Ohms law and series parallel circuit, electromagnetism, generation of AC and DC supply.

Idea of Basic electrical circuit: Electrical supply and load and its functioning, division of voltage and current in a parallel and series circuit ± simple problems, units of power and energy, solution of DC circuit with calculation of energy consumption in an installation.

Circuit parameters: Resistance, Capacitance and inductance. AC circuit with R, L, C. Simple solution of typical AC circuit with resistance, impedance, power and power factor.

Electrical circuit of an installation: Earthing, lightning protection.

PART I (e): Essentials of Electronics Engineering (5 Marks)

Active and passive devices ± review only. LED ± working, applications, comparison of LED lighting and CFL lighting. Full wave rectifier ± diagram and explanation, 5 V power supply ± with bridge rectifier and 7805. SMPS ± block diagram and advantages. Integrated circuits. SMDs ± advantages. Static electricity ± precautions in handling electronic circuits.

Switches: ON / OFF, push to ON, push to OFF, push to ON / OFF, SPST, SPDT, DPDT. Working and application of limit switches, proximity switches, relays.

Microcontrollers: Simple block diagram of 8 bit microcontrollers ± application.

Mobile technology: CDMA and GSM. Compare ± 2G and 3G technologies.

Inverter & UPS: Block diagram. Compare ± inverter and UPS. Online and off line UPS ± differentiate. Battery selection for UPS and inverter.

E-waste: Health hazards of e-waste.

Part II (14 Marks)

Transducers & its Classification: Variable resistance transducers, Variable Inductance transducers, Magnetic transducer, Variable Capacitive transducer, Piezoelectric transducer, Photoelectric transducer, Radiation detectors.

Telemetry System: Data transmission ± General Telemetry system, block Diagram ± Characteristics of Telemetry system. Land Line telemetry system. Voltage Telemetry System ± Current Telemetry System ± motion balance and Force balance telemetry systems. Synchro Transmitter and Receiver ± Position Telemetry System ± Position Telemetry system with synchros.

Fibre Optic Communication System: Principle of Optical Fibres. Block diagram of fiber optic communication system. Wavelength division multiplexing. Optical fiber construction. Single mode step index fiber, multi mode step index fiber and multimode graded index fiber ± comparison. Acceptance angle and Numerical aperture. Propagation of light through optical sensors. Types of Fiber optic sensors. Losses in optical fiber cable. Light sources and detectors used in fiber optic communication systems.

PART III (14 Marks)

Temperature Measurement: Mercury in glass thermometer, Mercury in steel thermometer, Gas and Vapour Pressure Thermometer, Bimetal, Radiation pyrometer, Optical pyrometer, PTC & NTC ± Thermistor, Solid State Temperature Transducers, Resistance Temperature Detector, Types, Thermocouple ± industrial thermocouples, thermopile.

Level Measurement: Float and Cable method of level measurement ± Float type magnetic level gauge ± Displacer type level indicator using torque tube ± Air purge type level indicator ± Capacitive conductive level indicator ± ultrasonic level gauge ± Radiation absorption method ± Laser method used

for level indication. Fiber optic level sensor ± Level switch ± Measurement of level of dry materials ± Level measurement using strain gauges - Level transmitter

Pressure Measurement: Definition and units, Different pressure measurement, U-tube manometers, Bourden tube pressure gauges, Bellows Diaphragms and Capsules ± Dead weight tester, Vacuum Measurement ± McLeod gauge, Pirani gauge & ionization gauge, Differential pressure transmitter for pressure measurement, Fiber optic pressure sensor.

Flow Measurements: Laminar and turbulent flow ± Reynold's number ± Continuity equation ± Bernoulli's equation for ideal fluid, Variable area and variable head type flow meters, Variable Head flow meter, Differential pressure flow transmitter, Special type flow meters, Electromagnetic flow meters ± Turbine flow meter ± Mass flow meters ± Ultrasonic flow meters ± Hot wire anemometer, Positive displacement flow meters, Open channel flow meters.

Viscosity Measurement: Saybolt's viscometer ± Redwood viscometer.

Specific gravity measurement, Humidity measurements, speed measurement, Torque measurement, Acceleration measurement.

PART IV : 14 Marks

Process Control: Block diagram, Process characteristics, Process parameters, Discontinuous controller modes, continuous controller modes, pneumatic controllers ± proportional controller ± PI controller ± PD controller ± PID controller.

Application of Operational Amplifiers in Process Control: Current to voltage ± voltage to current converter ± precision rectifier & Comparators ± error detector ± instrumentation amplifiers ± proportional controller ± PI controller ± PD controller ± PID controller.

Final Control Element and Control Valves: Pneumatic, electric and hydraulic actuators, air to open and air to close control valves, Direct acting & Reverse acting Control valves. Different valve plugs control valve characteristics, valve positioner, motion transmitter, limit switch, air pressure regulator & I/P converter.

Process Control Strategies: Single variable, Independent variable, Interactive variable, compound variable and multivariable control, Feedback control system, Feed forward control system, Cascade control system \pm Ratio control system \pm Adaptive control system \pm Split Range Control System, Adjustment and Tuning of controllers, Data loggers, Data acquisition system, Supervisory control, Direct Digital control, DCS, PLC, SCADA system for industrial automation, Intelligent control, biological neural networks, artificial neural network, fuzzy logic \pm concept, open-loop ANN controller and closed-loop ANN controller

Process flow diagrams (PFDs), Process and Instrument diagrams (P&IDs) and Loop diagrams (^aloop Sheets^o) \pm Lines & Symbols \pm codes \pm tags.

PART V : (14 Marks)

Numerical Control: NC and CNC, Hydraulic and pneumatic systems, working of hydraulic pumps, Air compressors, Air receiver, air dryers and air service equipment

Motion converters: Parallel shaft gears, epicyclic gears, harmonic drives, worm and bevel gears, V belt drives, toothed rack and pinion and screw nut systems, cams indexing mechanisms, linkages, spring and dampers.

Robotics: Specification of Robots, classification of Robots, Industrial applications of Robots, characteristics, sensors used in Robotics, Programming: Lead through programming, textual programming, programming language, online and offline programming, intelligent robots.

Control System:

Physical systems \pm physical model \pm mathematical model \pm linear time invariant and linear time variant system. Open loop and closed loop. Transfer function of linear systems, mechanical translational system, mechanical rotational system, electrical system, thermal systems, analogous systems.

Block diagram reduction, Signal flow graph

Time Response Analysis: Test inputs, order of a system, - Response of a system. Time response specification, type of a system, Static error coefficients, Routh Hurwitz criteria, root locus methods, Bode Plot.

Power Devices: Power diode, SCR, TRIAC, DIAC, Triggering and commutation of SCR, Converters, AC Controllers, Inverters.

AC and DC drives: Dual Converters, Choppers, Speed control of DC drives.

PART VI : (14 Marks)

Bioelectricity \pm Resting and action potential \pm transmission of impulses

Blood Pressure Measurement, Blood Flow Meters: Electrical activity of the heart, Electrocardiograph (ECG), Electroencephalograph (EEG), Electromyograph (EMG), Cardiac pacemakers, Cardiac Defibrillators, Diathermy, Hemo-dialysis machine, Respirators, Ventilators.

Blood Cell Counter.

X-ray Machine & Computed Axial Tomography (CAT)

Ultrasonic Imaging \pm Magnetic resonance Imaging

UV & Visible Photometer, Infrared Photometers, Flame photometers, Mass spectrophotometer, Nuclear Magnetic Resonance spectrometer, Raman spectrophotometer.

PH Measurements, Chromatography, analyzers, Thermal conductivity gas analyzer, paramagnetic oxygen analyzer, electrical conductivity analyzer ± Zirconia oxygen analyzer, Infrared analyzers.

Lasers: Characteristics and Classification of LASER.

Scientific applications of Laser ± Industrial applications of Laser ± Military applications of Laser ± Medical applications of Laser.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.