

Gate 2014 Exam Syllabus for Instrumentation Engineering

General Aptitude(GA)-Multiple Choice Test

- **This Paper Consists of Verbal Ability:** English grammar, verbal analogies, instructions, critical reasoning and verbal deduction, Sentence completion, Word groups

Engineering Mathematics- Mathematical branch that includes mathematical methods and techniques that are generally employed in Industry and engineering.

- **Linear Algebra: Branch of mathematics which does study of operation and applying it to find an answer to equations.** It include Topics-Matrix Algebra, Eigen values and eigen vectors, System of Linear Equations.
- **Calculus: Mathematical study of change.** It include topics-Theorems of integral calculus, Mean Value Theorem, Evaluation of definite and improper integrals, Maxima and minima, Partial Derivatives, Multiple integrals, Fourier series. Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems, Vector Identities
- **Differential equations: Deals with rate of change and slope of curves.** It include topics-First order equation (linear and nonlinear), Cauchy's and Euler's equations, Method of Variation of parameters, Initial and boundary value problems, Partial Differential Equations and variable separable method, Higher order linear differential equations with constant coefficients
- **Complex variables: Comes under analysis of category of complex.** It include topics-Analytic functions, Taylor's and Laurent' series, Residue theorem, solution integrals, Cauchy's integral theorem and integral formula.
- **Probability and Statistics: Probability is the way to roughly judge the occurrence of a thing or to what extent a statement is true.** It includes topics-Sampling theorems, Mean, median, Conditional probability, mode and standard deviation, Random variables, Discrete and continuous distributions, Correlation and regression analysis, Poisson, Normal and Binomial distribution.
- **Numerical Methods: It consists of set of rules which uses numerical approximation to find an answer to the problems of mathematical analysis.** It include topics-Single and multi-step methods for differential equations, Solutions of non-linear algebraic equations.
- **Transform Theory: Analysis of transforms.** It include topics-Fourier transform, Z-transform, Laplace transform.

Instrumentation Engineering-

- **Basics of Circuits and Measurement Systems:** It includes the basic knowledge regarding circuits and its different measurement system. It includes topics- Kirchoff's laws, nodal and mesh Analysis. Circuit theorems. Two-port and one-port Network Functions. dynamic and static characteristics of Measurement Systems. Statistical analysis of data and curve fitting. Error and uncertainty analysis.
- **Transducers, Mechanical Measurement and Industrial Instrumentation:** Transducer changes one form of energy into another. It includes topics- Capacitive, Resistive, Inductive and piezoelectric transducers and their signal conditioning. Measurement of Velocity, displacement and acceleration (rotational and translational), force, vibration, torque and shock. Measurement of pressure, temperature, flow and liquid level. Measurement of pH, viscosity, conductivity and humidity.
- **Analog Electronics: Electronic systems/devices having continuous variable signal.** It includes topics- Characteristics of diode, JFET, BJT and MOSFET. Diode circuits. Transistors at high and low frequencies, Amplifiers, multi-stage and single-stage. Feedback amplifiers. Operational amplifiers, characteristics and circuit configurations. Instrumentation amplifier. Precision rectifier. I-to-V and V-to-I converter. Op-Amp based active filters. Oscillators and signal generators.
- **Digital Electronics: Electronic systems that consists of discrete values of signal.** It includes topics- Combinational logic circuits, minimization of Boolean functions. IC families, MOS, TTL and CMOS. Arithmetic circuits. Schmitt trigger, Comparators, timers and mono-stable multi-vibrator. Sequential circuits, counters, flip-flops, shift registers. Multiplexer, S/H circuit. Digital-to-Analog converters and Analog-to-Digital. Basics of number system. Microprocessor applications, input-output interfacing and memory. Microcontrollers.
- **Signals, Systems and Communications: A signal that carry a information. System is a set of components which interact with each other to form an integrated whole.** It includes topics- aperiodic and periodic signals. Impulse response, transfer function and frequency response of second and first order systems. Convolution, correlation and characteristics of linear time invariant systems. Discrete time system, frequency and impulse response. Pulse transfer function. FIR and IIR filters. frequency and Amplitude modulation and demodulation. Sampling theorem, pulse code modulation. time and frequency division multiplexing. Frequency shift keying, Amplitude shift keying and pulse shift keying for digital modulation.
- **Electrical and Electronic Measurements: It make use of electronic systems that is used to affect electrons or their associated fields.** It includes topics- potentiometers and Bridges, measurement of R, C and L. Measurements of current, Voltage, power factor, power and energy. D.C & A.C current probes. Extension of instrument ranges. Q-meter and waveform analyzer. Digital voltmeter and multi-meter. phase, Time and frequency measurements. Cathode ray oscilloscope. parallel and Serial communication. Shielding and grounding.

- **Control Systems and Process Control: Devices that control, administer, supervise or directs other devices.** It include topics- Signal flow graphs. Feedback principles. Transient Response, steady-state-errors. Nyquist and Routh criteria. root loci Bode plot. Time delay systems. Gain and phase margin. State space representation of systems. hydraulic, mechanical and pneumatic system components. Synchro pair, servo and step motors. On-off, cascade, P-I,P, P-I-D, feed forward and derivative controller, Fuzzy controllers.
- **Analytical, Optical and Biomedical Instrumentation: Large class of instruments use to study materials and to set up the composition. Develop, manufacture and utilize tools for optical purpose(optical) . To Monitore low voltage biological signals(biomedical).** It include topics-Mass spectrometry. UV, visible and IR spectrometry. X-ray and nuclear radiation measurements. Optical sources and detectors, laser,LED, Photo-diode, photo-resistor and their characteristics. Interferometers, applications in metrology. Basics of fiber optics. Biomedical instruments, ECG,EEG and EMG. Clinical measurements. Ultrasonic transducers and Ultrasonography. Principles of Computer Assisted Tomography

