

**School of Instrumentation
Devi Ahilya Vishwavidyalaya, Indore**

**Syllabus for
Ph.D./M.Phil. Entrance Test**

**Subject: Instrumentation
PART A**

Part-A shall consist of 50 objective type compulsory questions of 1 mark each based on research methodology. It shall be of generic nature, intended to assess the research aptitude of the candidate. It will primarily be designed to test reasoning ability, data interpretation, and quantitative aptitude of the candidate

PART B

Part-B shall also consist of 50 objective type compulsory questions of 1 mark each based on the syllabus of the subject at Masters Level as follows:

Unit 1: Measurements:

Static and dynamic characteristics of measurement systems. Standards and calibration, Error and uncertainty analysis, Statistical analysis of data and curve fitting. Linear and angular measurements; Measurement of straightness, flatness, roundness and roughness. Measurement of R, L and C; Bridges and potentiometers, Measurements of Voltage, current, power, power factor and energy. Instrument transformers, Q-meter, Waveform analyzers, Digital Voltmeters and Multimeters, Time, Phase and Frequency measurements, Oscilloscope, noise and interference instrumentation.

Unit 2: Sensors and Transducers:

Transducer fundamentals: Transducer terminology, Classification, Performance characteristics, Criterion for selection. Measurements of displacement, Velocity (linear and rotational), acceleration, shock vibration, force, torque, power, strain, stress, pressure, flow, temperature, humidity, viscosity, and density. Introduction to Vacuum Gauges. Actuators: Mechanical, electrical, hydraulic, pneumatic. Advances in sensors: Use of fiber in temperature, image, displacement, pressure, flow liquid level sensors.

Unit 3 Control Systems

Introduction, open and closed loop control systems, differential equations of physical systems, transfer functions, block diagram, reduction techniques, signal flow graphs, feedback characteristics of control systems. Basic control component, transient and steady state response analysis. Stability of linear systems. Routh-Hurwitz criterion, relative stability, root-loci technique, root-contours, frequency response analysis, correlation between time and frequency response, polar plots, Bode plots, stability in frequency domain, Nyquist stability criterion, compensation techniques.

Unit : 4 Analog and Digital Electronics

Characteristics of diodes, BJTS, JFETS and MOSFETS, Diode circuits, Amplifiers, Single and multistage feedback, frequency response, Operational Amplifier- Design, Characteristics,

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linear and non-linear applications, difference amplifiers, Instrumentation amplifiers, Precision Rectifiers, I to V converters, Active filters, Oscillators, Comparators, Signal generators, Wave shaping circuits. Combinational logic circuits, minimization of Boolean functions, IC families (TTL, MOS CMOS) arithmetic circuits, multiplexers and decoders, sequential circuits: flip-flops, counters, registers, semiconductor memories: Types of RAM & ROM. Schmitt triggers, timers and multivibrators. Analog switches, multiplexers, sample and hold circuits, analog to digital and digital to analog converters: types of ADC and DAC.

Unit 5 Microprocessor and Interfacing

Microprocessors and assembly language, Microprocessor architecture and microcomputer systems. 8085 types of instructions, addressing modes, delay programmes, stack and subroutines. BCD arithmetic 16 bit data operations. Interfacing memory and I/O devices, I/O mapped, I/O and memory mapped I/O. Interfacing ADC and DAC to processor. Interrupts, priorities of interrupts, interrupt circuits. DMA. Interfacing devices: 8155/8156, 8255, 8253, and 8259. Data transfer scheme- Programmed data transfer, synchronous and asynchronous data transfer, serial and parallel interface.

Unit 6 Analytical Instrumentation

Different physical characterization of materials, Electrical characteristics. Hall mobility. Differential thermal analysis. Thermo gravimetric analysis. Bulk characterization. Spectrophotometers, Polarimeters. Online analyzers: Sampling systems for gas and liquids, fluid density monitors, consistency and viscosity analyzers, thermal conductivity gas analyzers, paramagnetic gas analyzers. Introduction to X-ray spectroscopy, X-ray diffraction, Extended X-ray absorption spectroscopy, X-ray photoelectron spectroscopy.

Unit 7 Programming in C

An overview of C, variables constants, operators and expressions in C, program control statements, functions in C, declaration of functions, passing values to functions. Arrays in C, initialization, arrays to functions, pointers in C, pointers as addresses, initialization. Structures, unions and user defined types and enumerations in C. Input/Output and disk files in C. Applying C to simple electronic circuit problems.

Unit 8 Engineering Mathematics

Matrices and Matrix algebra, transpose, Rank, Inverse of Matrix, Cramer's rule, eigen value problem. Ordinary differential equations. Partial differential and its applications, Vector calculus: Gradient, divergence and curl. Fourier series, Laplace transforms, Fourier Transform, Numerical methods to solve algebraic and Transcendental equations. Numerical solutions to ordinary differential equations.

Recommended Books:

1. Electronic Measurements and Instrumentation, Oliver and Cage
2. Electronic Instrumentation & Measuring Techniques, W. Cooper
3. Let us C, Y. Kanitkar

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4. Theory and Problems in C (Schuam Series), B. S. Gottfried
5. Higher Engineering Mathematics, B. S. Grewal
6. Advanced Engineering Mathematics, M. D. Greenberg
7. Op-amps and Linear Integrated Circuits, R. A. Gayakwad,
8. Integrated Electronics, Millman and Halkias, 3. Electronic Principles, A. P. Malvino
9. Electrical and Electronics Measurement and Instrumentation, A. K. Sawhney
10. Electronic Instrumentation & Measuring Techniques, W. Cooper
11. Control Systems Engineering, Gopal and Nagrath
12. Modern Control Engineering, Ogata
- 13. Automatic Control Systems, B.C. Kuo**
14. Digital Computer Electronics, A. P. Malvino
15. Digital Systems: Principles and Applications, R. J. Tocci
16. Digital Logic and Computer design, M. Moris Mano
17. Microprocessor Architecture, Programming and Applications R. S. Gaonkar,
18. Digital Computer Electronics A. P. Malvino
19. Introduction to Microprocessor, L. A. Lventhal
20. Introduction to Chemical Instrumentation, B. K. Sharma
21. Handbook of Analytical Instrumentation, B. S. Khandpurkar
22. Instrument Technology Vol. 2, B. E. Noltongk