भारतीय सूचना प्रौद्योगिकी संस्थान भागलपुर
INDIAN INSTITUTE OF INFORMATION TECHNOLOGY BHAGALPUR
(An Institute of National Importance Under Act of Parliament)
BCE Campus, Bhagalpur-813210, Bihar, India.

Date: 21/10/2022

Syllabus and Instructions for Written Test

With reference to Advt. No.: IIITBH/ADVT/2022/RECT/05, Ref. No.: IIITBH/REG/459/FAC/2022/1193, dated 14-09-2022, for post of Assistant Professor (On Contract, Grade-II, Level-10, AGP-6000) in (a) Dept. of Computer Science and Engineering, (b) Dept. of Electronics and Communication Engineering, and (c) Dept. of Mechatronics Engineering, the instructions for written test, presentation, and personal interview are as follows:

1. The written test will be conducted in **offline mode** at IIIT Bhagalpur in the month of December-2022 tentatively after the second week.

2. The written test will be conducted in two phases. Phase-I: **General Aptitude Test**, and Phase-II: **Departmental Core Subjects**.

3. The syllabus for written test of **General Aptitude Test** will be as per GATE syllabus, and it is common for all the departments.

4. The syllabus for written test of **Department Core Subjects** will be as per respective departmental GATE syllabus for the post of **Assistant Professors (On Contract, Grade-II, Level-10, AGP-6000)** for the Dept. of Computer Science and Engineering, and Dept. of Electronics and Communication Engineering.

5. The syllabus for written test of **Department Core Subjects** for the post of Assistant Professors (On Contract, Grade-II, Level-10, AGP-6000) for the Dept. of Mechatronics Engineering is enclosed in **Annexure-I**.

6. You are instructed to report 30 minutes before the examination at the Institute. Any delay in reporting, you will not be allowed for written test.

7. Any electronic gadgets are not allowed during the written examination. It is responsible of the candidate to keep their electronic gadgets in safe. Institute will not be responsible for any loss.

8. On the basis of written test, the shortlisted candidates will be eligible for PPT presentation and personal interview.

9. All the applicants are instructed to bring their original degree/marksheets and relevant documents for the verification of uploaded documents. The documents verification will be done only for shortlisted candidates who will be appearing for presentation and personal interview.

10. You are instructed to visit the institute website regularly for any further update/ information.

Annexure-I

The topics for written test in Mechatronics Engineering department is as follows:

(Section 1 to 3 from GATE-Mechanical Syllabus, and Section 4 to 6 from GATE- Electrical Engineering Syllabus)

Section 1: Engineering Mathematics

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors. Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Complex variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.

Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Section 2: Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Section 3: Materials, Manufacturing and Industrial Engineering

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes.

Section 4: Electrical Machine

Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Types of losses and efficiency calculations of electric machines.

Section 5: Signals and Systems

Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Applications of Fourier Transform for continuous and discrete time signals, Laplace Transform and Z transform.

Section 6: Control Systems

Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems, R.M.S. value, average value calculation for any general periodic waveform.