

# **M. Tech. (QROR) Admission Test 2023**

## **Syllabus: PQB**

### **PART I: MATHEMATICS**

- Quadratic equation. Roots of polynomial. AP, GP, HP. Divisibility and Prime numbers. Binomial theorem.
- Inequalities. Permutation and combination. Complex numbers and De Moivre's theorem.
- Elementary set theory. Functions and relations. Matrices: determinant, rank and inverse, symmetric matrix. Eigen values and eigen vector. System of linear equations.
- Trigonometry: multiple and sub-multiple angles, inverse circular functions, identities, solutions of equations, properties of triangles.
- Coordinate geometry (2-dimensional): straight line, circle, parabola, ellipse and hyperbola. Plane geometry. Mensuration.
- Sequences. Series: convergence and divergence, power series. Limit and continuity of functions of one or more variables. Differentiation and its applications: maxima and minima. Integration: indefinite and definite integrals, area computation. Ordinary and partial differential equations (up to second order).

### **PART II (SECTION S): STATISTICS-PROBABILITY**

#### **Statistics**

- Descriptive statistics for univariate, bivariate and multivariate data.
- Standard univariate probability distributions [Binomial, Poisson, Normal] and their fitting, properties of distributions. Sampling distributions.
- Theory of estimation and tests of statistical hypotheses.
- Simple and Multiple linear regression, linear statistical models, ANOVA.
- Principles of experimental designs and basic designs [CRD, RBD & LSD].
- Elements of non-parametric inference.
- Elements of categorical data analysis.
- Sample surveys – simple random sampling with and without replacement, stratified and cluster sampling.

#### **Probability**

- Classical definition of probability and standard results on operations with events, conditional probability and independence.

- Distributions of discrete type [Bernoulli, Binomial, Multinomial, Hypergeometric, Poisson, Geometric and Negative Binomial] and continuous type [Uniform, Exponential, Normal, Gamma, Beta] random variables and their moments.
- Bivariate distributions (with special emphasis on bivariate normal), marginal and conditional distributions, correlation and regression.
- Multivariate distributions, marginal and conditional distributions, regression, independence, partial and multiple correlations.
- Order statistics [including distributions of extreme values and of sample range for uniform and exponential distributions].
- Distributions of functions of random variables.
- Multivariate normal distribution [density, marginal and conditional distributions, regression].
- Weak law of large numbers, central limit theorem.
- Basics of Markov chains and Poisson processes.

## **PART II (SECTION E): ENGINEERING**

### **Engineering Mechanics and Thermodynamics**

- Forces in plane and space, analysis of trusses, friction, work-energy principle, moment of inertia, plane motion of rigid bodies, belt drive, gearing, principles of strength of materials, beams, columns.
- Laws of thermodynamics, internal energy, enthalpy, work and heat, reversible changes, adiabatic changes, heat formation - combustion, reaction, solution and dilution, entropy and free energy and maximum work function, reversible cycle and its efficiency, principles of internal combustion engines.

### **Electrical and Electronics Engineering**

- DC circuits, AC circuits (1- $\phi$ ), energy and power relationships, transformer, DC and AC machines, concepts of control theory and applications.
- Network analysis, 2 port network, transmission lines, elementary electronics (including amplifiers, transistors, oscillators, op-amp circuits), analog and digital electronic circuits, basics of computer architecture.

### **Engineering Drawing**

- Concept of orthogonal projection, point projection, line projection, projection of objects, sectional view of simple mechanical objects, isometric view, sketch of machine parts.

*(Use of Geometry Box containing Set Square, Compass, Diagonal Scale and Pencil is allowed)*