INDIAN STATISTICAL INSTITUTE

INSTRUCTIONS

The test is divided into two sessions (i) Forenoon session and (ii) Afternoon session. Each session is for two hours. For the forenoon session question paper, the test code is **MMA** and for the afternoon session question paper, the test code is **QRB**. Candidates appearing for JRF (QROR) should verify and ensure that they are answering the right question paper.

The test **QRB** is of short answer type. It has two groups. A candidate has to answer **two** of the **three** questions from **Group A** and **three** of the **six** questions from **Group B**.

OUTLINE OF THE SYLLABUS FOR QRB

The syllabus for JRF (QROR) will include the following subject groups:

1. Group A

    i)   Mathematics
    ii)   Probability and Statistics

2. Group B

    i)   Operations Research
    ii)   Reliability
    iii)   Statistical Quality Control

A broad coverage for each of the above subject groups is given below.

A. **Mathematics**: Permutations and Combinations, Binomial theorem, Theory of equations, Inequalities, Complex Numbers, Elementary Set Theory, Functions and relations, Matrices, Determinants, Basic properties of group. Vector spaces-Basis, Rank, Dimension, Linear Transformation, Inner product. Eigenvalues and eigenvectors, System of linear equations.

Limits, continuity, and differentiability of functions of single and several variables. Sequences, Power series, Taylor series, and Maclaurin series. Convergence and divergence. Differentiation and integration of functions of one variable with applications. Rolle's theorem and Mean Value Theorem. Proper and improper integrals. Maxima and minima single and multi-variables functions. (all at B.Sc. level).

B. **Statistics**: Probability and distribution theory, Bivariate distributions, Multivariate normal distribution, Estimation, Test of hypothesis, Analysis of variance, Regression and linear models, Design of experiments (block design, full and fractional factorial designs), Markov chain.

C. **Operations Research**: Linear programming (basic theory, simplex algorithm and its variants, duality theory, transportation, and assignment problem), Non-linear programming-basic theory, Game theory (two-person zero-sum game), Inventory theory, Queuing theory.

D. **Reliability**: Coherent systems and system reliability, Hazard function, Failure time distribution, Censoring schemes, Estimation and testing in reliability, Replacement models, Repairable system.

E. **Statistical Quality Control**: Statistical process control – attribute and variable control charts, Control charts with memory (CUSUM, EWMA, etc.) (univariate only), Process capability analysis, Acceptance sampling (single and double sampling plan).