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GOVERNMENT OF ARUNACHAL PRADESH
DEPARTMENT OF PLANNING
ITANAGAR.

SYLLABUS FOR DIRECT RECUITMENT OF RESEARCH
OFFICER
STATISTICS – PAPER –I (Pg. No. 2-6) & II (Pg. No. 7-14)

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(PAPER- I)

MATHEMATICAL ANALYSIS

- UNIT I:** Recap of elements of set theory; Introduction to real numbers. Introduction to n -dimensional Euclidean space; open and closed intervals (rectangles), compact sets, Bolzano – Weierstrass theorem, Heine – Borel theorem.
- UNIT II:** Sequences and series; their convergence. Real valued function; continuous functions, uniform continuity. Differentiation; maxima – minima of functions, functions of several variables, constrained maxima – minima of functions.
- UNIT III:** Multiple integrals and their evaluation by repeated integration, change of variables in multiple integration, Improper integrals. Differentiation under the sign of integral – Leibnitz rule.

LINEAR ALGEBRA

- UNIT I:** Vector spaces over fields of scalars, subspaces, linear independence of vectors, basis and dimension of a vector space, completion theorem, orthogonality of vectors and subspaces, Vector spaces with an inner product, gram-Schmidt orthogonalization process, orthonormal basis, linear transformations and projections and their representation by matrices.
- UNIT II:** Non-singular matrices and their inversion, determinants, ranks, row and column rank of a matrix, Idempotent matrix, its properties, trace, invariance theorems, Sylvester and Frobenius inequalities, elementary matrices, partitioned matrices, G – inverse, Kronecker product. Systems of homogeneous and non-homogeneous linear equations, their consistency and maximal linearly independent solutions, minimal and characteristic polynomials of a square matrix, characteristic roots and vectors, Cayley – Hamilton theorem, similarity and diagonalization of square matrices. Real quadratic forms and their value classes, canonical reductions and simultaneous reducibility of quadratic forms.

PROBABILITY THEORY

- UNIT I:** Classes of sets, fields, sigma-field, Borel sigma-field in \mathbb{R}^k , sequence of sets, limsup and liminf of a sequence of sets. Measure, Probability measure, properties of a measure, Caratheodory extension theorem (statement only).
- UNIT II:** Measurable functions as limit of simple functions, Random variables, sequence of random variables, almost sure convergence, convergence in

probability (and in measure). Integration of a measurable function with respect to a measure. Expectation and moments. (statements of) Monotone convergence theorem, Fatou's lemma, and Dominated convergence theorem (and discussion).

UNIT III: Probability inequalities (Tchebyshef, Markov, Jensen). Independence Borel-Cantelli Lemma, Kolmogorov zero-one law and Borel zero-one law. Kolmogorov's Strong Law of Large numbers for iid sequences.

UNIT IV: Convergence in distribution, characteristic functions and their elementary properties, Inversion and Uniqueness theorem (statement and discussion), Polya's theorem and Levy's continuity theorem (statement only), de Moivre-Laplace Central Limit Theorem (CLT), Lindeberg-Levy's CLT, statement and discussion of Lindeberg-Feller's CLT.

DISTRIBUTION THEORY I

UNIT I: Joint, marginal and conditional pmfs and pdfs. Computations of probability, expectations and variances by conditioning, Generating functions (m.g.f and p.g.f) of random variables, their properties and applications.

UNIT II: Some continuous distributions (Cauchy, pareto, Weibull, lognormal), Bivariate normal and bivariate exponential distributions and their properties, multinomial distribution.

UNIT III: Functions of random variables and their distributions using Jacobian and other tools, convolution and compound distributions, truncated and mixture distributions.

UNIT IV: Sampling distributions from normal population central and non-central Chi-square, t and F distributions.

DISTRIBUTION THEORY II

UNIT I: Order statistics and their distributions and properties. Joint and marginal distributions of order statistics. Extreme values and their asymptotic distribution (statement only) with applications, Asymptotic distribution of median, distribution of quantities.

UNIT II: Multivariate normal distribution, p.d.f and c.d.f moments, marginal and conditional distributions.

UNIT III: Distribution of linear and quadratic forms in normal variables, expectations, variances and covariances, characteristic functions, independence of