Syllabi for M.Phil./Ph.D. Coursework Entrance Examination for the Session 2019-20

DEPARTMENT OF STATISTICS

Max. Marks- 100

Note: The question paper will contain 100 questions in all spread over four units. Each Unit has equal weightage which contains 25 multiple choice type questions based on entire syllabus given in the Unit. The candidate is required to attempt 75 questions each of marks 4/3. There will be no negative marking. The duration of the question paper is 75 minutes.

Unit I

Probability Theory

Definitations of Probability, Baye's Theorem, Random Variables and Distribution Functions (Univariate and Multivariate), Probability Mass function, Probability Density Function, Movements of Random Variables: Expectation, Variance and Covariance. Probability and Moment Generating Function and their Properties, Convergence in Probability, Almost Surely, r^{th} Mean and In Distribution Convegence, Probability Inequalities. Weak and Strong Laws of large numbers, Central Limit Theorem (Independently Identically Distributed case)

Statistical Methods

Skewness and Kurtosis, Standard Discrete and Continuous Univariate, Distributions. Correlation and Regression for two and more Variables. Large and Small Sample Tests. Standard Errors and Asymptotic Distributions, Distributions of Order Statistics and Range.

Statistical Inference

Point Estimation: Methods of Estimation, Properties of Estimators, Neymann Theory of Testing of Hypotheses: Types of Hypotheses and Errors, Critical Region, Level of Significance, Power of the Test, Construction of Uniformly and Most Uniformly Powerful Test, Likelihood Ratio Test, Derivation and its Properties, Asymptotic Distribution of L.R. Test, Confidence Interval.

Unit II

Sampling Techniques

Types of Sampling, Errors in Sampling, The Estimation of Mean Total. Proportion and Ratio. Determination of Sample Size for Specified Precision Stratified Sampling: Proportional and Optimum Allocation. Construction of Strata and Determination of Number of Strata. Ratio and Regression Methods. Bias of The Ratio Type Estimate, Unbiased Ratio Type Estimate, Ratio Estimate in Stratified Sampling. Sampling with Varying Probability, Sampling with Probability Proportional to Size. Two Stage Sampling, Estimate of Population Mean and its Variance, Optimum Allocation for Fixed Cost

Multivariate Analysis

Multivariate Normal Distribution, Wishart Distribution and their properties, Principal Component Analysis, Discrimination Analysis, Canonical Correlation.

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Designs of Experiments

Completely Randomized Designs, Randomized Block Designs and Latin–Square Designs, Connectedness and Orthogonality of Block Designs, BIBD. 2x Factorial Experiments: Confounding and Construction.

Applied Statistics

Index Numbers: Types, Uses and Construction. Components of Time Series, Trend Measurement by Mathematical Curves, Polynomial, Growth Curves. Measurement of Mortality and Fertility. Construction of a Complete Life Table and Its Uses. Abridged Life Tables. Relation Between TFR And CBR, Gross Reproduction Rate and Net Reproduction Rate, Replacement Index. Standardized Fertility Rate.

Unit III

Stochastic Processes & Queuing Theory

Stochastic Processes: Definition, Classification and Examples. Branching Process: Probability of Extinction and Distribution of Total Progeny. Random Walk: First Passage Time and Gambler's Ruin Problem. Markov-Chains: Classification of States and Chain, Higher Transition Probabilities, Stability of Markov Systems. Poisson Process: Classifications and Related Distributions. Birth and Death Processes: Yule-Furry Process and Generalization. Linear Birth-Death Process.

Queuing systems: M/M/1, M/M/C, M/M/∞, M/M/1/R, and M/M/C/K Models with Waiting time Distribution and their Steady State Solutions

Operation Research Models
Deterministic and Probabilistic Inventory Models.

Linear Programming

LPP and its Solution Properties. Methods for the Solution of LPP. Artificial Variable Technique. Degeneracy in LPP and its Resolution. Duality Problem in LPP. Transportation Problems: Mathematical Formulation and Fundamental Properties. Initial Basic Feasible Solution of Transportation Problems. Assignment Problems: Mathematical Formulation and Solution by Hungarian Assignment Method. Reduction Theorem. Sensitivity in Assignment Problems. Theory of Games: Characteristics of Game and Solution of Games with or without Saddle Point

Unit IV

Numerical Analysis

Numerical Solution of Algebraic Equations: Regula-Falsi Method, Newton-Raphson Method. Intrapolation and Extrapolation, Numerical Differentiation and Integration, Numerical solution of ODEs using. Picard, Euler, modified Euler and Runge-Kutta Methods.

Complex Analysis

Functions of a Complex Variable, Analytic Properties. Cauchy's Riemann Equations. Radius of Convergence of Power series. Mobius Transformation, Cross Ratio, Invariant Point and Critical point. Complex integral: Cauchy's Theorem, Cauchy's integral formula, Liouville's theorem, Taylor series, Laurent series. Singularities and its type. Calculus of residues.

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Linear Algebra

Vector space, Linear and Orthognal Transformation of a Matrix. Eigenvalues and Eigenvectors, Inner Product of Vectors, Orthonormal Basis. Quadratic Forms: Reduction to Diagonal and Cannonical Form. Signature and Index of the Quadratic Form.

Real Analysis

Toplogy of Real Numbers: Open Set, Closed Set, Limit Point of a Set, Boundedness of a Set. Convergence and Divergence of Sequences. Cauchy's Theorem on Limits, Sequence and Series of Functions and Their Convergence Properties. Riemann integral. Outer measure, measureable sets, measurable functions and lebesgue integral.

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