SCHOOL OF STUDIES IN STATISTICS

VIKRAM UNIVERSITY, UJJAIN

THE M.Phil / Ph.D ENTRANCE TEST SYLLABUS 2020-21

[As per M.Phil. Ordinance no.13 and Ph.D. Ordinance no.11]

The Test will have the question paper in **two parts A and B.**

The Syllabus for **Part A**: **Research Methodology [Common to all subjects of faculty of Science** (i.e. 1. Physics 2. Mathematics 3. Statistics 4. Chemistry 5. Geology 6. Pharmacy)]. 50x1=50

Part-A shall consist of **50 objective type** compulsory questions of 1 mark each based on **Research Methodology**. It shall be of generic nature, intended to assess the research aptitude of the candidate. It will primarily be designed to test reasoning ability, data interpretation and quantitative aptitude of the candidate.

23/7/18

Sanjay K. Gupta

THE M.Phil./Ph.D. ENTRANCE TEST SYLLABUS 2020-21

Syllabus for Part-A: Research Methodology 50×1=50

[Common to all subjects of faculty of Science (i.e.1. Physics 2. Mathematics 3. Statistics 4. Chemistry 5. Geology 6. Pharmacy)].

- Meaning of research, Objective of research, Types of research, Research approaches, Significance of research, Research methods versus research methodology, Research process, Criteria of good research.
- Research Problem, Selecting the problem, Necessity of defining the problem, Technique involved in defining problem.
- Meaning of Research Design, Need for Research Design, Feature of good Design, Important Concepts Relating to Research Design: Dependent and Independent variables, Extraneous Variable, Control, Confounded Relationship, Research Hypothesis, Experimental and Non-Experimental Hypothesis, Experimental and Control Groups, Treatments, Experiment, Experimental unit (s), Research Designs in Case of Exploratory Research Studies, Descriptive and Diagnostic Research Studies.

- Quantitative and Qualitative data, Classification of Measurement Scales: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale. Goodness of Measurement Scale: Validity, Reliability and Practicality.

- Types of data: Primary and Secondary, Methods of Collecting Primary data: Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Difference between questionnaires and schedule, Collection of secondary data.

- Classification of data, Tabulation, Diagrammatic and Graphical representation of data: Bar chart, Pie chart, Box plot, Histogram, Frequency polygon, Frequency Curve, Ogive.

- Measure of Central Tendencies: Mean, Median, Mode .

  Measures of Variability: Range, Quartile Deviation, Standard Deviation and Coefficient of variation.

- Meaning of Correlation, Scatter diagram, Karl Pearson Coefficient of Correlation, Rank Correlation, Regression lines, Regression coefficients, Properties of regression coefficient. Normal Distribution and its Properties

- Testing of Hypothesis and Test of significance: Null and Alternative Hypothesis, Type I and Type II errors, Critical region, Level of significance, One-Tailed and Two- Tailed Tests, Large sample tests: Test of significance for single proportion, Difference of proportions, Single mean and difference of means, Chi –Square test of goodness of fit and independence of attributes. Small sample tests: t-test for single mean, t-test for difference between two sample means, Paired t-test for difference of means, F-test for equality of population variances.

- Analysis of Variance.

- Computer languages and Operating System(OS)-Assembly language, Machine language, MS-DOS and Windows.

- MS-Word and Power point presentation.

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THE M.Phil./Ph.D. ENTRANCE TEST

SYLLABUS 2020-21

Syllabus for Part- B: Statistics 50×1=50

PART –B shall consist of 50 objective type compulsory questions of 1 mark each.

23/7/18

THE M.Phil./Ph.D. ENTRANCE TEST

Syllabus for Part- B: Statistics 50×1=50

- Axiomatic approach to probability, Conditional probability. Baye's theorem. Discrete and Continuous random variables; Probability mass function, Probability density function, Distribution function; Joint distribution of two random variables, marginal and conditional distributions. Mathematical expectation and their properties, Conditional variance. Moment generating function, Characteristic function, Probability generating function and their properties. Tchebychev's inequality and its application, Weak law of large numbers (WLLNs), Strong law of large numbers (SLLNs) and Central limit theorems. Standard univariate discrete distributions and their properties: Binomial, Poisson, Geometric, Hyper geometric and Negative Binomial distributions. Standard continuous distributions: Uniform, Normal, Exponential, Beta and Gamma distributions.
- Stratified random sampling and allocation problem, Systematic sampling, Cluster sampling, Two-stage sampling, Two-Phase sampling, Estimators of population mean and standard errors in these sampling schemes. Sampling with varying probability of selection, Hurwitz-Thompson estimator, Probability proportional to size (PPS) sampling. Ratio, Product and Regression methods of estimation.
- Control charts for variables and attributes, Acceptance sampling by attributes: single, double and sequential plans. OC and ASN functions, AOQL and ATI, Acceptance sampling by variables. Tolerance limits. Hazard function, distribution with DFR and IFR. Series and parallel systems. Life testing experiments.
- Elements of linear programming problem (LPP), Simplex procedure in presence of slack, surplus and artificial variables, Duality in LPP and Duality theorem, Transportation and Assignment problems, Two person zero sum game, saddle point, maximin- minimix principle, Dominance and modified dominance principles, Elements of queuing theory, Poisson process, Inter-arrival time distribution, finite and infinite M/M/1 and M/M/K queuing models, Dynamic programming and Integer programming.

- Unbiasedness, Consistency, Efficiency, and Sufficiency of an estimator, Cramer Rao inequality, Rao-Blackwell theorem, Bhattacharya bounds. Methods of Estimation: Methods of moments, Methods of maximum likelihood, Properties of maximum likelihood estimator(MLE), Method of Chi-Square, Method of least squares, Consistent asymptotically normal estimates, Risk function, Admissibility, Complete class, Bayes and minimax solutions. Size and power of a test, Neyman-Pearson lemma, Most powerful test, Randomized and Non –Randomized test, Uniformly most powerful (UMP) tests, Likelihood ratio test, Test for parameters of Binomial and Poisson distributions.t, F and Chi-Square distributions and their properties. Non-parametric tests: Sign test, Wilcoxon –Mann-Whitney test, Run test and Median test, Kolmogorov –Smirnov tests for one sample and two samples, Exponential family distributions.

- Basic principles of experimental design, Analysis and layout of Completely randomized, Randomized block and Latin square design, Missing plot technique in one - way and two - way classifications. Factorial experiments (2^n and3^2), Concepts of main and interaction effects, Confounding, Split and Strip plot designs, Basics of Incomplete block design, Balanced Incomplete block design (BIBD), Partially balanced incomplete block design (PBIBD) with recovery of intrablock information and Simple lattice design.

- Time series and its components, Methods of determining trends, Seasonal and Cyclic components. Index numbers, Link and chain relatives, Chain base index numbers, Tests in connection with index numbers, Cost of living index numbers, Consumer's demand and analysis, Price elasticity of demand, Engle Curve.

- The general linear model, Method of least squares, Normal equations, Solutions of normal equations, Estimability of a linear parametric function, Best linear unbiased estimator (BLUE), The Gauss-Markoff theorem, Variances and Covariances of BLUEs, Estimation space, Error space.

- Estimation of parameters in a single equation model: Classical least squares, Generalized least squares, Heteroscedasticity, Error in variables models,

Serial correlation, Multicollinearity. Indirect least square and Two-stage least squares.

- Multivariate normal distribution and its marginal and conditional distributions, Wishart's distribution and its reproductive property, Hotelling T^2 and its properties, Mahalonobis D^2, Principal components, Canonical correlation.

- Measurement of mortality and fertility, Gross and Net reproduction rates, Complete and Abridged life tables and their construction, Population projection using Gompertz and Makeham logistic curve.