Syllabus of M. Phil./ Ph.D. Entrance Examination in Statistics, 2019-20.

The M. Phil. Course offered in Statistics shall be based on the admission test conducted by the University for this purpose. M. Phil. entrance test examination will be of two hrs. duration. The test shall consist of 100 marks. There will be 30 multiple choice questions with two marks each and 8 short answer type questions with 5 marks each. Atmost 50 words will be set for each short answer type question. The medium of entrance examination will be English. No revaluation will be permitted in any circumstances.

The questions in the M. Phil. entrance examination will be asked on the following topics:

(1) Statistical Methods
(2) Statistical Inference
(3) Sampling Theory
(4) Design of experiments

1. Statistical Methods

Frequency distribution, measures of location, dispersion and skewness, Moments and cumulates, moment generating function.
Simple correlation coefficient, Rank correlation, Multiple and Partial Correlation. Regression. Curve fitting.

Definition of probability, Bays theorem, Basic distribution function probability mass function, probability density function, joint, marginal and conditional p.m.f. Random Variable and its mathematical expectation, conditional Expectation, Expectation of sum and multiplication of random variables.

Standard Discrete Distributions- Bernoulli, Binomial, Poisson, Geometric, Hyper geometric and Multinomial distribution. Limiting form of Binomial and Poisson distributions.

Standard Continuous distributions- Uniform, Exponential, Normal and Cauchy distributions.

Sampling distributions. Chi-square, t- and F- distributions. Sampling distributions of mean and variance of a sample from a normal population.

2. Statistical Inference

Unbiasedness , Consistency, efficiency and sufficiency of point estimator , Fisher –Neymann factorization theorem, Cramer Rao inequality, Minimum Variance unbiased estimators.

Liklihood function, examples from standard discrete and continuous distributions. such as Bernoulli, Binomial, Possion, Normal, Exponential Gamma etc)

Methods of estimation – Method of maximum likelihood estimators, properties of maximum likelihood estimators. Method of scoring, method of moments, method of minimum chi-square, method of minimum variance, B.A.N. estimators.

Rao Blackwell theorem. Invariant estimators, Confidence interval and confidence coefficients, Confidence interval for large samples.

Concepts of critical regions, Test functions, two kinds of errors. Size function, power function, level, M. P. and U,M.P. Test, Neymann Pearson Lemma, M. P. test for simple null against simple alternative hypothesis ,UMP test for simple null hypothesis against one sided alternatives in one parameter exponential family .Unbiased test, UNIFORMELY most powerful unbiased test.

Liklihood ratio test and its properties. Likelihood ratio test for the mean of normal population, LR test for equality of means and variances of two and several normal populations.

Non parametric test, Rank test, Wilcoxon test, Median test, Sign test, Mann-Whitney U test, Wald-Wolfowitz run test, Kolomogorov-Smirnov test, One sample location problem, chi square test of goodness of fit.

3. Sampling Theory

Sample Surveys: Simple random sampling, Estimation of population proportion, Non-sampling errors.

Stratified sampling, Optimum allocation, Neyman allocation and Proportion allocation, systematic sampling, Comparison of stratified, systematic and simple random sampling, estimation of gain in precision due to stratification, Post Stratification, Systematic sampling under a linear model.

Ratio and regression estimators. Bias of ratio estimate, optimum property of ratio estimate, Regression estimate with pre-assigned and with estimated regression coefficient, comparison of ratio and regression estimate with sample mean.

Unequal probability sampling: pps methods [including Lahiri's scheme] and related estimators of a finite population mean.

Cluster sampling. Two stage sampling, Hurwitz-Thompson estimation.

4. Design of Experiments

Introduction to design of experiments, Principles of design of experiments, Completely randomized design, Randomized block design, Latin square design. Missing plot technique-general theory and applications, efficiency of design. Factorial experiments, Split Plot Design.