Admission to the Ph.D. Programme in Statistics: 2015

Procedure:

1. The conditions for eligibility will be guided overall by the rules specified in the notification no. QCSR/34/06 regarding Regulations for the Degree of Doctor of Philosophy (Ph.D.) of the University of Calcutta (http://www.caluniv.ac.in/Phd_Dlit/phd%20regu.htm)

2. Eligibility: Candidates with an M.Sc. or equivalent degree in Statistics and allied subjects from any UGC recognized University/Institute are eligible to apply for admission in the Ph.D. programme.

3. The admission procedure consists of a written test followed by an interview for candidates successful in the same. Those who have qualified NET / SET (Mathematical Sciences) / GATE (Mathematics) or hold a UGC Teachers’ Fellowship or already obtained M.Phil. in Statistics and allied subjects or M. Tech. (QR&OR) degree of ISI prior to the application deadline will be exempted from the written examination but will have to appear in the interview.

4. Number of seats: 54.

5. Reservations will be followed as per West Bengal Higher Educational Institutions (Reservations in Admissions) Rules, 2013.

Application Deadlines:

Date of Advertisement : 

Last date of submission of application form : July 24, 2015

Date of common written test : August 11, 2015

Result of common written test : August 18, 2015

Date of Interview : August 31, 2015

Date of publication of selection list : September 14, 2015

Application forms may be downloaded from the university website (http://www.caluniv.ac.in/admission/CU RET Form.pdf). Note that candidates who are eligible for waiver of the written test are also required to complete and submit the application form by the above deadline to:

Head, Department of Statistics
University of Calcutta
35 Ballygunge Circular Road
Kolkata – 700035, W.B., INDIA
Course Work (PhD Programme):

One Semester Course Work of 20 credits as follows:

1. Literature Review and seminar : 4 credits
2. Seminar Presentation : 4 credits
3. Research Methodology : 4 credits
4. Evolution of Statistics : 4 credits
5. Statistical Computing : 4 credits

Structure of the written examination:

1. There will be 25 multiple choice questions each carrying 2.5 marks out of which one has to answer 20 questions. If a candidate answers more than 20, only the first 20 answered will be evaluated.

2. There will be 15 short answer type questions of 5 marks each out of which one has to answer 10 questions. If a candidate attempts more than 10, only the first 10 attempted will be evaluated.

3. Pass marks for the test will be announced in due course.

4. Candidates successful in the written examination would have to compete with other eligible candidates who have already cleared NET / SET / GATE / M. Phil / M. Tech. (QR&OR) at the interview stage. The list of finally selected candidates would be posted in the University website and Departmental Notice Board.

5. Candidates selected for the final interview will be required to submit a Statement of Purpose (SoP) that should at least specify his/her areas of interest by a specified date before the interview. However, the selection committee may, at its discretion, require a candidate to opt for a topic/area other than his/her initial choice before admitting him/her into the Ph.D. programme. The final date for submitting the SoP will be announced along with the intimation for the interview.
Detailed Syllabus for common M.Phil-PhD Entrance Examination:

Real Analysis

Probability
Fields, sigma-fields and generators, semifields, Borel sigma-field on R and R^k. Monotone classes, Measurable functions and properties, compositions; product sigma-fields, Borel sigma-field on Euclidean spaces.
Measures, finite, sigma-finite measures. Probability measures, properties. Independence of events, Borel-Cantelli lemmas.
Extensions of measures, Lebesgue measure on R and R^k. induced measures.
Discrete and absolutely continuous distributions. probability densities.
Convergence in probability and almost sure.
Product measures. Fubini's theorem.
Kolmogorov's 0-1 law. Weak and strong laws of large numbers. Kolmogorov's inequality.
Convergence in distribution. Integration of complex-valued functions, characteristic functions.
Inversion and Continuity theorems. Central Limit Theorems.
L_p-convergence of random variables. Connections between various modes of convergence (in distribution, in probability, L_p, almost sure).
Absolute continuity and singularity of measures. Radon-Nikodym theorem.

Linear Algebra and Linear Programming
Vectors and Matrices: Vector spaces and subspaces, Linear dependence and independence, span, basis, orthogonality and orthonormality, Matrix algebra.
Linear programming: Graphical Solution and Simplex Algorithm

Sampling Distributions
Non-central χ^2, t & F distributions – definitions and properties. Distribution of quadratic forms – Cochran’s theorem.

Large Sample Theory
Scheffe's theorem, Slutsky's theorem. Asymptotic normality, multivariate CLTs, delta method.
Glivenko-Cantelli Lemma
Asymptotic distributions of sample moments and functions of moments, Asymptotic distributions of Order Statistics and Quantiles. Consistency and Asymptotic Efficiency of Estimators, Large sample properties of Maximum Likelihood estimators. Asymptotic distributions and properties of Likelihood ratio tests, Rao’s test and Wald’s tests in the simple hypothesis case.
Statistical Inference

Linear Models

Regression Analysis

Design of Experiments
Block Designs: Connectedness, Orthogonality, Balance and Efficiency; Resolvable designs; Properties of BIB designs, Designs derived from BIB designs. Intrablock analysis of BIB, Lattice and PBIB designs, Row column designs, Youden Square designs; Recovery of inter-block information in BIB designs; Missing plot technique. Construction of mutually orthogonal Latin Squares (MOLS); Construction of BIB designs through MOLS and Bose’s fundamental method of differences. Factorial designs: Analysis, Confounding and balancing in Symmetric Factorials.
Sample Surveys
Probability sampling from a finite population – Notions of sampling design, sampling scheme, inclusion probabilities, Horvitz-Thompson estimator of a population total.
Basic sampling schemes – Simple random sampling with and without replacement, Unequal probability sampling with and without replacement, Systematic sampling. Related estimators of population total/mean, their variances and variance estimators – Mean per distinct unit in simple random with replacement sampling, Hansen-Hurwitz estimator in unequal probability sampling with replacement, Des Raj and Murthy’s estimator (for sample of size two) in unequal probability sampling without replacement.
Two-stage sampling with equal/unequal number of second stage units and simple random sampling without replacement / unequal probability sampling with replacement at first stage, Ratio estimation in two-stage sampling. Double sampling for stratification. Double sampling ratio and regression estimators. Sampling on successive occasions.

Bayesian Analysis
Different Priors and related Posteriors
Estimation, testing and prediction for Univariate Normal distribution with known / unknown mean and / or variance.
Hierarchical and Empirical Bayes under normal setup.
Prior and posterior analysis in Generalized linear models

Decision Theory
Risk function, Admissibility of decision rules, Complete, essentially complete, minimal complete and minimal essentially complete classes. Essential completeness and completeness of class of rules based on sufficient statistic and the class of nonrandomized rules for convex loss

Resampling Techniques
Introduction to Jackknife and Bootstrap-methods for estimating bias, standard error and distribution function based on iid random variables, standard examples Bootstrap confidence intervals.

Missing Data Analysis
Informative or non-informative missingness; complete case / available case estimation, Imputation, EM & MCEM algorithms and data augmentation techniques. Standard error estimation.

Stochastic Processes
Poisson process. Renewal Theory: renewal processes, renewal function, elementary renewal theorem, applications, Blackwell's theorem and key renewal theorem (statements), applications, alternating renewal processes, applications to limiting excess and age.
Time Series Analysis

Multivariate Analysis
Multivariate normal distribution and its properties- marginal and conditional distributions. Random sampling from a multivariate normal distribution- UMVUE and MLE of parameters, joint distribution of sample mean vector and SS-SP matrix; Wishart distribution and its properties. Distribution of sample correlation coefficients, partial and multiple correlation coefficients partial regression coefficient and intraclass correlation coefficient. Distributions of Hotelling’s $T^2$ and Mahalanobis’ $D^2$ statistics- their applications in testing and confidence set construction. Multivariate linear model, MANOVA for one-way and two-way classified data.

Clustering: Hierarchical clustering for continuous and categorical data- different choices of proximity measures, Agglomerative and Divisive algorithms. K-means clustering- optimum choice of the number of clusters.


Principal Component Analysis: Population and sample Principal components and their uses. Plotting techniques, Large sample inferences.


Canonical Correlations: Population and sample canonical variables and canonical correlations and their interpretations. Plotting techniques, Large sample inferences.