Admission to the Ph.D. Programme in Statistics: 2014

Procedure:

1. The conditions for eligibility will be guided overall by the rules specified in the notification titled *University of Calcutta (Regulations for the Degree of Doctor of Philosophy, Ph.D.), Regulations 2009* ([http://www.caluniv.ac.in/Phd_Dlit/PhD%20rules.pdf](http://www.caluniv.ac.in/Phd_Dlit/PhD%20rules.pdf))

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. The written test is common to the Ph.D. and M.Phil. programmes for the year 2014. A candidate who qualifies for the Ph.D. programme is automatically eligible to join the M. Phil. programme instead, if he/she chooses. However, for exercising this choice, such a candidate must have applied also for the M. Phil. programme by the relevant deadline. The two programmes cannot be pursued simultaneously.

5. Number of seats in the Ph.D. programme: 58

6. Reservations will be applicable as per existing rules.

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**Date of Advertisement**: 

**Last date of submission of application form**: September 26, 2014

**Date of common written test**: October 14, 2014 (12 noon - 2 p.m.)

**Result of common written test**: October 21, 2014

**Date of Interview**: November 05, 2014 (from 12 noon)

**Date of publication of selection list**: November 17, 2014

Please 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.
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 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 brief will be announced along with the intimation for the interview.
Detailed Syllabus for common M.Phil-PhD Entrance Examination:

Real Analysis

Probability

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

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).

**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**
Empirical distribution function and its properties
Jackknife and Bootstrap procedures for estimating bias and standard error.
Consistency of the Jackknife variance estimate in an iid setup.
Bootstrap confidence intervals.

**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**
Volatility – ARCH, GARCH models.

**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.

**Applied Multivariate Analysis**
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

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.