UNIVERSITY OF CALCUTTA

Admission Notice for 2 Yr. M.Phil course in
Statistics and Computer Applications for the session 2017-2019

Applications are invited in prescribed format for admission in 2 Yr. M.Phil course in Statistics and Computer Applications in the Department of Statistics, C.U. for the session 2017-2019 from the candidates with M.A. / M.Sc. in Statistics of this University with 55% marks in aggregate (SC / ST with 50% marks) or with 60% marks in aggregate of any other recognized University. Students who are taking M.Sc. final examinations in Statistics may also apply provisionally and sit for the common M.Phil-PhD written test but their final admission would depend on passing the examination obtaining the required marks mentioned above. Visit Admission Section of the website www.caluniv.ac.in. Prescribed format of Form is available in the website.

The programme is guided by general terms and conditions available at http://www.caluniv.ac.in/PhD-Dlit-Dsc/mphil-csr-2016.pdf

Duly Filled-in application form along with the application fees of Rs.200/- (for general & other candidates) and Rs.100/- (for SC / ST / PH candidates), either by DD in favour of "University of Calcutta" or by C.U. cash challan deposited at Calcutta University cash counter, and self attested copies of academic documents should be submitted within date specified below to the Assistant Secretary Office, C.U. Ballygunge Science College Campus, 35 Ballygunge Circular Road, Kolkata – 700019 except Saturday, Sunday and holidays between 11.30 A.M. and 4.30 P.M.

Reservation:	As per University Rules
Total seats:	10 + 1 (for OBC candidate)
Exemption from entrance test:	UGC-NET(including JRF)/UGC-CSIR NET (including JRF)/SET/ GATE/teacher fellowship holder or equivalent examination

Schedule of Admission Procedure:

Date of Advertisement	:	
Last date of submission of application form	:	September 7, 2017
Date of common written test	:	September 11, 2017 (12 noon - 3 p.m.)
Result of common written test	:	September 15, 2017
Date of Interview	:	September 21, 2017 (from 12 noon)
Date of publication of selection list	:	October 24, 2017

Fees Structure:

Course Fee	:	Rs.1000/- per Month
Laboratory Fee	:	Rs. 200/- per Month
Library Fee	:	Rs. 200/- per year
Admission Fee	:	Rs.1000/- at the time of admission
Session Charge	:	Rs. 44/- per annum
Identity Card	:	Rs. 50/- at the time of admission

At the time of admission 6 months tuition fee & Laboratory fee and 2 Years Library fee in addition to other normal fees to be deposited.

Dr. Amit Ray
Secretary,
UCSTA, C.U.

Affix
Passport Size
Photograph
duly attested

APPLICATION FORM

M PHIL. IN STATISTICS & COMPUTER APPLICATIONS, 2017-2019

UNIVERSITY OF CALCUTTA

UNIVERSITY COLLEGE OF SCIENCE, TECHNOLOGY AND AGRICULTURE

To
The Secretary
Faculty Councils for P.G. Studies in Sc., Tech. & Engg and Ag. & Vet. Sc.
Calcutta University

Name of the Applicant (in block letters): ____
Bachelor's degree in Engg./Tech. or M.Sc. with Subject: ___________________________________
College and University: ____
Year of entry in BE /BTech /M.Sc.: ________________________ Year of passing: _____________
GATE Score, if any ____________________________ Year_____________________________
Applied for admission in Course: ____________________________
Subject: ____________________________
Whether admitted earlier in this course, give details: __________________________

Date of birth: _______________ Whether employed: ___________________________
Category: **GEN** ☐ **SC** ☐ **ST** ☐ **OBC-A** ☐ **OBC-B** ☐ **PH** ☐

Statement of marks in Bachelor's degree in Engg / Tech or M.Sc. examination:

Examination	**Semester / Part**	**SGPA**	**CGPA**	**Total marks obtained**	**Total marks of exam**	**Class/Div.,**	**% of marks**
	I						
	II						
	III						
	IV						
	V						
	VI						
	VII						
	VIII						

Statement of marks in the following Examinations:

Examination	**Board/ University**	**Year of passing**	**Total marks obtained**	**Full marks of exam.**	**Grade/ GP**	**Class /Div.**	**% of marks**
Madhyamik or equiv. (10)							
HS or equivalent (10+2)							
B.Sc. (Hons.) (10+2+3)							
Diploma in Engg. / Tech							

For website Version form: C.U. Cash Challan No_______________ Date_________________
Or DD. No.______________ Date___________ Issuing Bank__________________________
(In reverse of DD, Please write the name and course applied for)

UNIVERSITY COLLEGE OF SCIENCE, TECHNOLOGY AND AGRICULTURE

1. Name of the applicant (in block letters)………………………………………………………………………………
2. Calcutta University Registration No. (for C.U. Students)…………………………………………………………..
3. Present address (if any) ……………………………………………………………………………………………
   ………………………………………………………………………………………………..
   …………… ……………………………………………………………………………….
   Telephone No……………….……Mobile………………………………..Email :…………………………………..
4. Permanent address. .…………………………………………………………………………………………….
   …………………………………………………………………………………………………….
   ……………………………………………………………………………………………………
   …………………………………………………… Telephone No…………………………….
5. Nationality ……………………………………. Domicile state …………………………………………………
6. Male / Female ………………………….…… 7. Married / Unmarried……………………………………….
8. Father's Name ………………………………………... Occupation ……………. Monthly Income …………
9. Mother's Name ……………………………………..… Occupation ……………. Monthly Income …………..
10. Husband's /Wife's name ………………………………… Occupation ……………. Monthly Income …………
11. Guardian's name, relationship and occupation ………………………………………………………………….
12. Income of the family per month ………………………………………………
13. Are you enjoying any scholarship or stipend (if yes, state the name of the sponsor) : …………………………………
14. Details of employment (if employed)

…….

DECLARATION / UNDERTAKING

I do here by declare / undertake that the statements made above by me are true. If any error/misinformation is detected after my provisional admission, my admission shall be treated as cancelled. I have not taken admission nor shall I take admission to any other course during my studies in this University without intimation. If I get admission I will be a full time student of this University (not applicable for part-time courses). If I remain absent from the classes continuously for seven days or intermittently for more than 50% of classes held during any two consecutive weeks, my studentship will be terminated and my name will be automatically struck off from the rolls according to the admission rules of the University.

Endorsed

____________________________ ____________________________

Signature of father/mother/husband/guardian Signature of the applicant

Date ……………………. Date ………………….

N.B.

1. Application must be accompany attested copies of all relevant Mark Sheets and Certificates as applicable
2. Birth Certificate. (10th standard Admit Card / Certificate)
3. Mark Sheet of Madhyamik Examination and onward
4. Aadhaar Card.
5. Certificate from appropriate authority for SC/ST/OBC-A/OBC-B/ PWD applicants, if applicable.
6. All documents and photo submitted must be signed by the candidate himself/herself.
7. Incomplete Forms are liable to be rejected.

2 Yr. M.Phil course in Statistics and Computer Applications 2017-2019

Structure of the written examination:

1. There will be 24 short answer type questions of 5 marks each out of which one has to answer 15 questions.
2. The qualifying marks for Entrance Test will be 50%.

Detailed Syllabus for common M.Phil-PhD Entrance Examination:

Real Analysis

Real Number System, Cluster Points of sets, Closed and open sets, Compact sets, Bolzano-Weierstrass Property, Heine-Borel Property. Sets of Real Vectors, Sequences and Series, Convergence. Real valued functions. Limit, Continuity and Uniform continuity. Differentiability of univariate function. Mean value theorems. Extrema of functions. Riemann integral. Improper integrals. Sequences and Series of functions, Uniform convergence, Power series.Term by term differentiation and integration,

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. Random variables, Distribution functions, measures in R and R^k. Probability distributions. Discrete and absolutely continuous distributions. probability densities.

Convergence in probability and almost sure.

Integration: simple, nonnegative, general measurable functions, integrability, MCT, DCT, Fatou's lemma. Change of variables. Holder's and Minkowski's inequalities. Expectations, moments. Jensen's inequality.

Product measures. Fubini's theorem.

Independence of random variables. Sums, variances, covariances. Second Borel-Cantelli lemma. 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.

Lp-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 (statement).

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
Sufficiency & completeness, Notions of minimal sufficiency,bounded completeness and ancillarity, Exponential family.Point estimation : Bhattacharya system of lower bounds to variance of estimators. Minimum variance unbiased estimators – Applications of Rao – Blackwell and Lehmann – Scheffe theorems.Testing of Hypothesis : nonrandomized and randomized tests, critical function, power function. MP tests – Neyman – Pearson Lemma. UMP tests. Monotone Likelihood Ratio families. Generalized Neyman – Pearson Lemma. UMPU tests for one parameter families. Locally best tests. Similar tests. Neyman structure. UMPU tests for composite hypotheses.
Confidence sets: relation with hypothesis testing. Optimum parametric confidence intervals. Sequential tests. Wald's equation for ASN. SPRT and its properties – fundamental identity. O.C. and ASN. Optimality of SPRT (under usual approximation).

Linear Models
Gauss Markov Model: Estimable function, error function, BLUE, Gauss Markov theorem. Correlated set-up, least squares estimate with restriction on parameters.
Linear Set, General linear hypothesis –related sampling distributions, Multiple comparison techniques due to Scheffe and Tukey.
Analysis of variance: Balanced classification, Fixed Effects Model, Random Effects Model and Mixed Effects Model; Inference on Variance components.
Regression analysis, Analysis of covariance.

Regression Analysis
Building a regression model: Transformations – Box-Cox model, Stepwise regression, Model selection (adjusted R2, cross validation and Mallow's Cp criteria, AIC and BIC), Multicollinearity.
Detection of outliers and influential observations: residuals and leverages, DFBETA, DFFIT and Cook's Distance.
Checking for normality: Q-Q plots, Normal Probability plot, Shapiro-Wilks test.
Departures from the Gauss-Markov set-up: Heteroscedasticity and Autocorrelation – detection and remedies.
Longitudinal Data Analysis – introduction with motivation. Exploring longitudinal data. Linear models for longitudinal data – introduction, mean models, covariance models, mixed effects models. Predictions.
Types of data. Two-way classified data – Contingency Tables and associated distributions, Types of studies, Relative Risk and Odds Ratio and their properties. More-than-two-way classified data – partial associations, marginal and conditional odds.
Generalized Linear Models: Introduction, Components of a GLM, Goodness of fit – deviance, Residuals, Maximum likelihood estimation.
Binary data and Count data: ungrouped and grouped. Polytomous data.
Over dispersion, Quasi-likelihood.
Models with constant coefficient of variation, joint modeling of mean and variance, Generalized additive models.
Discrete longitudinal data - generalized linear marginal models, GEE for marginal models, Generalized linear subject specific models and transition models.

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 probabilites, 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.Stratified sampling – Allocation problem and construction of strata.Ratio, Product, Difference and Regression estimators. Unbiased Ratio estimators – Probability proportional to aggregate size sampling, Hartley – Ross estimator in simple random sampling. Sampling and sub-sampling of clusters. 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
Empirical distribution function and its properties
Jackknife and Bootstrap 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.
Markov chains: time-homogeneity, one-step & multi-step transition probabilities, Chapman-Kolmogorov equations, Markov times, strong Markov property, classification of states, stationary distributions, periodicity, ergodicity, convergence, convergence rate. Examples: birth-and-death processes, branching processes.
Jump-Markov processes: conservativeness, transition probabilities, holding times, embedded Markov chain, Chapman-Kolmogorov equations, Kolmogorov backward and forward equations, stationary distributions. Examples: pure birth, birth-and-death chains, Markovian queues.

Time Series Analysis
Stationary time series. Autocorrelation and partial autocorrelation functions. Correlogram.
Box-Jenkins Models – identification, estimation and diagnostic checking.
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 clusters.
Classification and discrimination procedures: Discrimination between two known populations – Bayes, Minimax and Likelihood Ratio procedures. Discrimination between two multivariate normal populations. Sample discriminant function. Likelihood ratio rule. Tests associated with discriminant function, Probabilities of misclassification and their estimation. Classification of several populations. Fisher’s method for discriminating among several populations.
Principal Component Analysis: Population and sample Principal components and their uses. Plotting techniques, Large sample inferences.
Factor Analysis: The orthogonal factor model, Estimation of factor loading, Factor rotation, Estimation of Factor scores, Interpretation of Factor Analysis.
Canonical Correlations: Population and sample canonical variables and canonical correlations and their interpretations. Plotting techniques, Large sample inferences.