Choice Based Credit System (CBCS) Syllabus for M.A./M.Sc. 1st Semester Statistics wef 2017 and onwards BOSPG held on 08/08/2017

General Instructions for the Candidates

1. The **two** years (**4 semesters**) PG Programmes is of **96** credit weightage i.e. **24** credits/semester (**24×4 = 96**).
2. Out of 24 credits in a semester a candidate has to obtain **12** credits compulsorily from the **Core Courses**, while the remaining 12 credits can be obtained from the **Electives(DCE, GE &OE)** in the following manner:
   - A candidate can obtain a maximum of **8** credits within his /her own Department out of specialization offered by the Department as**Discipline Centric Electives**.
   - **4** credits shall be obtained by the candidate from the **Electives (GE , OE)** offered by the Department other than his/her own. The candidate shall be free to obtain these **4** credits from the **General** or **Open Elective or a Combination of Both.**

SEMESTER I			
Course Type	**Course Code**	**Title of the Course**	**No. of Credits**
Core (CR)	ST17101CR	Probability and Distribution Theory - I	**04**
	ST17102CR	Sampling Techniques	**04**
	ST17103CR	Statistical Computing	**04**
Discipline Centric Elective (DCE)	ST17104DCE	Stochastic Processes	**04**
	ST17105DCE	Linear Algebra	**02**
	ST17106DCE	Practical based on ST17101CR	**02**
	ST17107DCE	Practical based on ST17102CR	**02**
	ST17108DCE	Practical based on ST17103CR	**02**
Generic Elective (GE)	ST17109GE	Statistical Methods	**02**
	ST17110GE	Testing of Hypothesis-I(Parametric)	**02**
Open Elective (OE)	ST17111OE	Time Series Analysis	**02**

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PROBABILITY AND DISTRIBUTION THEORY-I

COURSE NO: ST17101CR **No. of Credits-4**

UNIT-I

Class of sets, fields, sigma fields, minimal sigma field, and Borel sigma field. Definition of probability: classical and relative frequency approach, discrete probability space, properties of probability based on axiomatic approach, Independence of events, conditional probability, total and compound probability rules. Bayes theorem and its applications.Random variable. Cumulative distribution function of random variables and its properties, probability function of a random variable.

UNIT-II

Joint distribution function and probability function of a random variable. Expectation of a random variable and its properties, conditional expectation, covariance and correlation. Moments, measure of location and dispersion of a random variable. Moment generating function, probability-generating function, Characteristic function of a real and vector valued random variables. Inversion formula, and Uniqueness theorem.

UNIT-III

Standard Univariate discrete distributions: Discrete Uniform, Bernoulli, Binomial, Poisson, Negative Binomial, Geometric, Hyper geometric, logarithmic distributions and their structural properties, relations and applications, Marginal and conditional distributions. Some idea of truncations.

UNIT-IV

Univariate Continuous distributions: Uniform, Beta, Gamma, Exponential, Pareto, Weibull, Laplace, Normal, Cauchy and their structural properties, relations and applications, Marginal and conditional distributions. Some idea of truncations.

TEXT BOOKS:

- Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition
- Rohatgi, V.K. (1994): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- Rao, R.C. (1973): Linear Statistical Inference and its Applications, 2/e, Wiley Eastern.

REFERENCES:

- Pitman. (1993): Probability, Narosa Publishing House.
- Johnson, S. and Kotz, (1972): Distribution in Statistics, vol. I, II and III, Houghton and Miffin.
- Johnson, Kotz and Kemp (1992): Univariate discrete distribution, John Wiley
- Cramer, H. (1946): Mathematical Methods of Statistics, Princeton.

SAMPLING TECHNIQUES

COURSE NO: ST17102CR **No. of Credits-4**

UNIT I

Simple Random Sampling: Concept of sampling design, expected value and sampling variance of the sample mean, expected value of the sample mean square and estimation of the variance. Determination of sample size. Simple random sampling as applied to qualitative characteristics.

UNIT II

Stratified random Sampling: Estimation of the population mean/total and its variance, choice of sample sizes in different strata, variance under different allocations.Comparison with unstratified sampling.Estimation of the gain in precision due to stratification, construction of strata.

UNIT III

Ratio and Regression methods of Estimation: Variance of the estimates, estimation of variances, optimum property of ratio and regression estimator. Ratio and regression estimator in stratified random sampling.Some modifications of ratio and regression estimators.Comparison among regression, ratio and simple unbiased estimates. Unbiased ratio type estimates.

UNIT-IV

Systematic Sampling: Sample mean and its variances. Comparison of systematic with simple random and stratified sampling in the general case and also in the case of linear trend.

Cluster sampling: Estimation of mean and its variance for equal and unequal clusters. Efficiency in terms of intra-class correlation.Optimum unit of sampling.Sampling with replacement and unequal probabilities.Estimation of mean and its variance.

TEXT BOOKS:

- Cochran, W. G: Sampling Techniques, 3rd edition, Wiley.
- Mukhopadhyay, P. (2000): Theory and Methods of Survey Sampling, Prentice Hall of India, Private limited, New Delhi
- Des Raj &Chandak(1998): Sampling Theory, Narosa.
- Murthy, M. N. (1977): Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
- Skate teal (1984): Sampling Theory of Surveys with Applications, Iowa State University Press, & IARS.
- Singh, D and Chuddar, F. S. (1986): Theory and Analysis of Sample Survey Design, New Age International Publisher.

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STATISTICAL COMPUTING

COURSE NO: ST17103CR **No. of Credits-4**

UNIT-I

Introduction to computers, Classification of computers, advantages, disadvantages and applications of computers, Basic set up of electronic computers, input and output devices. Basic idea about computer packages (statistical Packages).

UNIT-II

Statistical Software's: MINITAB reading & Manipulation of data, Commands/Statements in MINITAB, Descriptive Statistics. Basic operations on matrices. Working with Software package MINITAB for graphics, EDA: Histogram, Plot, Box plot, Pi-chart, QQ plot, density plot, and Stem and Leaf.

UNIT-III

Using MINITAB: Correlation &Regression analysis: simple and multiple. Tests of significance, Errors in sampling, Critical region and level of significance, Test of significance of large samples, Test of single proportion, Test of significance of difference of proportions.

UNIT-IV

Using MINITAB: Chi-Square test for independence of attributes and Contingency table, t-test, Paired t-test, Test for correlation in sampling from normal population, F-test, testing of two variance of two univariate normal population.

TEXT BOOKS:

- B. Ryan and B.L. Joiner (2001). MINITAB Handbook, Fourth edition, Duxbury.
- R.A. Thisted (1988): Elements of Statistical Computing, chapman and Hall.
- S.C. Gupta & V.K Kapoor (2012), Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition.

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STOCHASTIC PROCESSES

COURSE NO: ST17104DCE **No. of Credits-4**

UNIT I

Introduction to Stochastic Processes (SP's); Classification of Stochastic Processes according to state space and time domain.Definition of Markov Chain and examples. Countable state Markov chains (MC's), Chapman-Kolmogrov equations; Calculation of n-step transition probability and its limit.

UNIT II

Stationary distribution, Classification of states: persistent state, transient state and ergodic state, examples, limiting theorems concerning states; Simple Random Walk Model and gambler's ruin problem; expected duration of the game, Probability of ruin at the nth trail. And Probability of a draw at the rth trial.

UNIT III

Markov Process with Discrete state space: Poisson processes, Poisson processes and related distributions, Birth and death process; Markov Process with Continuous state space, Brownian Motion, Wiener Process, Differential equations for a Wiener Process, Kolmogorov Equations.

UNIT IV

Introduction of Branching process: Galton-Watson branching process, properties of generating functions of branching process and distribution of population size, Calculation of moments of Branching Process and distribution of total progeny. Probability of ultimate extinction, numerical illustrations.

TEXT BOOKS:

- Medhi, J. (1982): Stochastic Processes, Holden-Day.
- Baily, N.T.J. (1965): The Elements of Stochastic Processes: John Wiley
- Jagers P. (1974): Branching Processes with Biological Applications, Wiley.
- Harris, T.E. (1963): The Theory of Branching Processes, Springer-Verlag.
- Hoel, P.G., Port, S.C. and Stone, C.J (1972): Introduction to Stochastic Processes, Houghton Miffin& Co.
- Karlin, S. and Taylor, H.M. (1975): A First Course in Stochastic Processes, Vol.1, and Academic Press.
- Basu, A.K. (2003): Introduction to Stochastic Processes, Narosa Publications.

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LINEAR ALGEBRA

COURSE NO: ST17105DCE **No. of Credits-2**

UNIT-I

Algebra of Matrices, trace of a matrix, trace of AB = trace of BA, Wielandt's Theorem as a simple consequence. Idempotent and nilpotent matrices, Inverse of partitioned matrices, linear independence and dependence of row (column) vectors, orthogonal and unitary matrices.

UNIT-II

Rank of a matrix, Linear equations, solutions of homogenous and non-homogenous equations, basic linear transformation, Eigen values and Eigen vectors of a matrix and their determination. Quadratic forms. Necessary and sufficient condition for a quadratic form to be positive definite.

TEXT BOOKS:

- Grabill, Walter(1976). Matrices with Applications in Statistics, 2nd Ed.Wadsworth.
- Roa,C.R.(1973), Linear Statistical Inference and its Applications, 2nd Ed.John Wiley and Sons,Inc.
- Searel, S.R.(1982).Matrix Algebra useful for Statistics. John Wiely and Sons,Inc.

COURSE NO: ST17106DCE No. of Credits-2

PRACTICAL BASED ON ST17101CR

COURSE NO: ST17107DCE No. of Credits-2

PRACTICAL BASED ON ST17102CR

COURSE NO.: ST17108DCE No. of Credits-2

PRACTICAL BASED ON ST17103CR

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STATISTICAL METHODS

COURSE NO: ST17109GE **No. of Credits-2**

UNIT-I

Descriptive Statistics: Measures of central tendency, Characteristic for an ideal measure of dispersion, Measure of dispersion range, quartile deviation, variance, standard deviation, co-efficient of variation, Skewness and Kurtosis.

UNIT-II

Measures of Co-relation: Scatter diagram, Karl Pearson Coefficient of correlation, Rank correlation, Regression, Lines of regression, Regression co-efficient, Fitting of regression lines.

TEXT BOOKS:

- S.C. Gupta & V.K Kapoor (2012), Fundamentals of Mathematical Statistics, Sultan Chand & Sons,
- Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition.
- Gupta S. C. and Kapoor V.K. (2001): Fundamental of Applied Statistics.

TESTING OF HYPOTHESIS-I (PARAMETRIC)

Course No: ST17110GE **No. of Credits-2**

UNIT I

The basic idea of significance test, Null and alternative hypothesis, two tailed and one tailed test of hypothesis, Type I & Type II errors, level of significance, critical region, degree of freedom, concept of p-value.

UNIT II

Test for large samples: test of mean, test for difference between mean of two samples, test for difference between the standard deviations of two samples. Tests of proportions: single and difference of proportion, Chi-square test: for independence of attributes and goodness-of-fit.

References:

- Daniel, Wayne W., Bio-statistics: A Foundation for Analysis in the Health Sciences. John Wiley (2005).
- Goon, A.M., Gupta M.K. & Das Gupta, Fundamentals of statistics, Vol.-I &II (2005).
- Dunn, O.J Basic Statistics: A primer for the Biomedical Sciences. (1964, 1977) by John Wiley.

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TIME SERIES ANALYSIS

COURSE NO: ST17111OE **No. of Credits-2**

UNIT –I

Introduction to time series, Components of Time Series:Secular Trend, Seasonal Variations, Cyclic Variations, Irregular variation., Mathematical Models of Time Series, Main objectives of analysing Time Series.

UNIT –II

Measurement of Trend, Graphical Methods, Method of Semi-Averages, Method of moving averages, Method of Least squares,fitting by Principle of Least Squares, Merits and Limitations of given methods.

References:

- Gupta S. C. and Kapoor V.K. (2001): Fundamental of Applied Statistics.
- Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis-Forecasting and Control, Holden-day, San Francisco.
- Anderson, T.W. (1971): The Statistical Analysis of Time Series, Wiley, N.Y.