B. Sc. STATISTICS
SEMESTER- I

Department of Statistics/Mathematics
JECRC University
SEMESTER – I

PAPER – I

STATISTICAL METHODS   Credits : 4

Types of data: Discrete and continuous data, Frequency and non-frequency data, Different types of scales, Primary data (designing a questionnaire and schedule), Secondary data (major sources including some government publication). Statistical Methods: Concepts of statistical population and sample from a population, quantitative and qualitative data, Nominal, ordinal and time series data, discrete and continuous data.

Presentation of data by table and by diagrams, Construction of tables (with one or more factors), diagrammatic and graphical representation of grouped data, frequency and cumulative frequency distribution and their applications, histogram, frequency polygon, cumulative frequency distributions (inclusive and exclusive methods) and ogive. Bivariate data-scatter diagram,

Concept of central tendency and its measures, partition values, dispersion and relative dispersion, moments, absolute moments and factorial moments Sheppard's correction for moments (without derivation), skewness, kurtosis and their measures.

PAPER - II

PROBABILITY and DISTRIBUTIONS   Credits : 4

Definition of probability, classical and relative frequency approach to probability, axiomatic approach to probability and its properties, merits and demerits of these approaches, total and compound probability, conditional probability theorems, independence of events, Bayes theorem and its applications. Random experiment: Trial, sample point, sample space, definitions of equally likely, mutually exclusive and exhaustive events,

Continuous random variable: Probability density function, distribution function, joint density function of two continuous variables, marginal and conditional probability density functions.

Discrete and continuous distributions: Uniform, binomial, Poisson, geometric, negative Binomial, hypergeometric, normal, beta, gamma, bivariate and Normal distributions.

B. Sc. STATISTICS
SEMESTER- II

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PAPER-I

DESCRIPTIVE STATISTICS   Credits : 4

Bivariate data: Scatter diagram, product moment correlation coefficient and its properties, coefficient of determination, correlation ratio, interclass correlation, concept of error in regression, principle of least square, fitting of linear regression and related results, rank correlation. Partial and multiple correlation in three variables, their measures and related results. Theory of attributes: Independence and Association of attributes, various measures of association for two way and three way classified data.

PAPER-II

DISTRIBUTION THEORY   Credits : 4

Expectation of random variable and its properties, conditional expectation, moment in terms of expectation, moment generating function of a random variable, their properties and uses, probability generating function, Tchebycheff's inequality and its applications, convergence in probability and in distribution.

Discrete and continuous probability distributions and their properties including degenerate distribution. Standard discrete and continuous distributions: Uniform, binomial, Poisson, geometric, negative Binomial, hypergeometric, beta, gamma, bivariate Normal distributions.

Books for References
1. Goon A.M., Gupta A.K. and Das Gupta B. (1999): Fundamental of Statistics, Vol. I, World Press, Calcutta.
2. Mood A.M., Greybill, F.A. and Bose D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
3. Hogg R.V. and Craig A.T. (1972): Introduction to Mathematical Statistics, Amerind Publishing Co.
4. Mukhopadhyay, P. (1996): Mathematical Statistics, New Central Book Agency.
5. Rohtagi V.K. (1967) : An Introduction to Probability Theory and Mathematical Statistics, John Wiley and Sons.
6. Hoel P.G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.

B. Sc. STATISTICS
SEMESTER- III
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PAPER-I

STATISTICAL INFERENCE -I   Credits : 4

Concept of random sample from a distribution, statistic and its sampling distribution, standard error of an estimate, standard errors of sample mean and proportion, sampling distribution of sum of Binomial, Poisson random variables and mean of normal distribution, requirement of a good estimator with examples. Simple, composite null and alternative hypotheses, critical region, types of error, level of significance, p-values, size and power of a test, chi-square, t and f distributions and their properties (without proof), testing of equality of two means and two variances of two normal distributions, testing for the significance of sample correlation coefficient and testing the equality of means and variances of bivariate normal distributions.

PAPER-II

STATISTICAL INFERENCE -II   Credits : 4

Statement of weak law of large number and central limit theorem, use of central limit theorem for testing a single mean, single proportion equality of two means and two proportions, Fisher's Z transformation and its uses, Pearson's chi-square test for goodness of fit, test of independence of two attributes. Definition of order statistics and their distributions, sign test, run test, median test, Spearmen's rank correlation test, Wilcoxon-Mann Whitney test, Kolmogorov, Smirnov one sample and two sample tests.

Books for References
1. Mood A.M., Greybill F.A. and Bose D.C. (1974) : Introduction to the Theory of Statistics, McGraw Hill.
2. Freund J.E. (2001) : Mathematical Statistics, Prentice hall of India.
3. Goom A.M., Gupta M.K. and Das Gupta B. (1991) : Fundamental of Statistics, Vol. I, World press, Calcutta.
4. Rohtagi V.K. (1967): An Introduction to Probability Theory and Mathematical Statistics, John Wiley and Sons.
5. Rao C.R. (1973) : Linear Statistical Inference and its Applications, Revised edition, Weley Eastern.
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6. Hoges J.L. and Lehmann E.L. (1964): Basic Concepts of Probability and Statistics, Holden Day.
7. Snedecor G.W. and Cochran W.G. (1967) : Statistical Methods, Iowa State University Press.

, E.S. : Mathematics of Statistics ,Vol.-I

B. Sc. STATISTICS
SEMESTER- IV

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PAPER-I

SAMPLE SURVEYS   Credits : 4

Concept of population and sample, need for sampling, complete enumeration versus sampling, Basic concepts in sampling, sampling and Non-sampling errors, Acquaintance with the working (questionnaires, sampling design, methods followed in field investigation, principal findings, etc.) of NSSO and other agencies under taking sample surveys.
Simple random sampling with and without replacement, estimation of population mean, population proportions and their standard errors. Stratified random sampling, proportional and optimum allocation, comparison with simple random sampling for fixed sample size.
Ratio, product and regression methods of estimation, estimation of population mean, evaluation of bias and variance to the first order of approximation, comparison with simple random sampling.
Systematic sampling (when population size (N) is an integer multiple of sampling size (n)). Estimation of population mean and standard error of this estimate, comparison with simple random sampling. Elementary idea of cluster sampling.

PAPER-II

DESIGN OF EXPERIMENTS   Credits : 4

Analysis of variance for one way and two way classifications, need for design of experiments, basic principle of experimental design: randomization, replication and local control, complete analysis and layout of completely randomized design, randomized block design and Latin square design.
Factorial experiments and their advantages, main and interaction effects in 2^2 and 2^3 factorial experiments.

Books for References
1. Cochran W.G. (1977) :Sampling Techniques, John Wiley and Sons, New York.
2. Sukhtme P.V., Sukhatme B.V., Sukhatme S. and Asok C. (1984) : Sampling Theory of Surveys with Applications, Indian Society of Agricultural Statistics, New Delhi.
3. Goon A.M., Gupta M.K. and Das Gupta B. (1986) : Fundamentals of Statistics, Vol. II, world Press, Calcutta.
4. Sampath S. (2000) : Sampling Theory and Methods, Narosa Publishing House, New Delhi.
5. Des Raj (2000) : Sample Survey Theory, Narosa Publishing House, New Delhi.
6. Murthy M.N. (1967) : Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
7. Kish L (1965): Survey Sampling, John Wiley and Sons, New York.
8. Hansen M.H., Hurwitz W.N. and Madow W.G. (1975) : Sample Survey Method and Theory, Vol. I, Methods and Applications, Vol. II, New York and London, Wiley Publication.
9. Cochran W.G. and Cox G.M. (1957) : Experimental Design, John Wiley and Sons.
10. Das, M.N. and Giri J. (1986) : Design and Analysis of Experiments, Springer Verlag.
11. Kempthorne O. (1965) : The Design and Analysis of Experiments, Wiley Eastern.

B. Sc. STATISTICS

SEMESTER- V
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PAPER – I

APPLIED STATISTICS- I   Credits : 4

Demographic Methods: Sources of demographic data, census, registration, ad hoc surveys, hospital records, demographic profiles of the Indian census.

Measurement of Mortality and Life Table: Crude death rate, Standardized death rates, Age-specific death rates, Infant Mortality rate, Death rate by cause, Complete life table and its main features, Uses of life table.

Measurement of Fertility: Crude birth rate, general fertility rate, age specific birth rate, total fertility rate, gross reproduction rate, net reproduction rate.

Index Numbers: Price relatives and quantity or volume relatives, Link and chain relatives composition of index numbers; Laspeyre's, Paasche's, Marshal Edgeworth's and Fisher's index numbers; chain base index number, tests for index number, cost of living index number.

PAPER-II

APPLIED STATISTICS- I   Credits : 4

Time Series Analysis: Economic time series, different components, illustration, additive and multiplicative models, determination of trend, seasonal and cyclical fluctuations.

Statistical process and product control: Quality of a product, need for quality control, basic concept of process control, process capability and product control, general theory of control charts, causes of variation in quality, control limits, sub grouping summary of out of control criteria. Charts for attributes : p chart, np chart, c-chart, V chart. Charts for variables: R,
(X, R), (X, σ) charts.

Books for References
1. Mukhopadhyay, P. (1994) :Applied Statistics, new Central Book Agency Pvt. Ltd., Calcutta.
2. Srivastava O.S. (1983) : A Text Book of Demography, Vikas Publishing House, new Delhi.
3. Benjamin B. (1959): Health and Vital Statistics, Allen and Unuwin.
4. Goon A.M., Gupta M.K. and Das Gupta B. (1986): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
5. Duncan A.J. (1974) : Quality Control and Industrial Statistics, IV Edision, Taraporewala and Sons.
6. Montomery, D.C. (1991): Introduction to the Statistical Quality Control, IInd Editions, John Wiley and Sons.
7. Brown R.G. (1963): Smoothing, Forecasting and Prediction of Discrete Time Series, Prentice Hall.
8. Chatfield C. (1980) : The Analysis of Time Series, IInd Edision Chapman and Hall.

B. Sc. STATISTICS
SEMESTER- VI
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PAPER-I.

DEMAND ANALYSIS, ANALYSIS OF INCOME DISTRIBUTION AND QUEUING THEORY

Theory and analysis of consumer's demand, law of demand, price elasticity of demand, estimation of demand curves, forms of demand functions, Engel's curve, income elasticity of demand.
Analysis of income and allied distributions : Pareto distribution, graphical test, fitting of Pareto law, illustration, lognormal distribution and properties, Lorenz curve, Gini's coefficient.
Elements of queuing theory, characteristics of queues, Poisson process, distribution of inter-arrival time, definition of steady state condition, (M/M/1) : (∞ / FIFO) and (M/M/1) : (N/ FIFO models, birth and death process, (M/M/K) : (∞ / FIFO) and (M/M/K) : (N / FIFO) models.
Finite and infinite length models with associated distribution of queue length and waiting time, steady – state solutions of ($M/E_k/ 1$) and ($E_k/ 1$) queues, machine interface problem.

Books for References
1. Kanti Swaroop, Gupta P.K. and Singh M.M. (1985) : Operations Research, Sultan Chand and Sons.
2. Hiller F.S. and Libermann G.J. (1995): Introduction to Operation Research, McGraw Hill.
3. Taha H.A. (1999) : Operation Research, Macmillan Publishing Company.
4. Mukhopadhyay P. (1999): Applied Statistics, New Central Book Agency Pvt. Ltd., Calcutta.
5. Goon A.M., Gupta M.K. and Dasgupta B. (1986): Fundamentals of Statistics, Vol.II, World Press, Calcutta.
6. Croxton F.E. and Cowden, D.F.: Applied General Statistics.
7. Asthana B.N. and Srivastava S.S.: Applied Statistics in India.

PAPER-II
ELEMENTS OF STOCHASTIC PROCESSES   Credits : 4
Definition and examples of stochastic process: classification of general stochastic processes into discrete/continuous time, discrete/continuous state spaces, types of stochastic processes elementary problems, random walk, gambler's ruin problem.
Markov chains: Definition and examples of Markov chain, transition probability matrix, classification of states, recurrence, simple problems, basic limit theorem of Markov Chain (statement only):, stationary probability distribution, applications.
Continuous time Markov Chain: Poisson process and related inter-arrival time distribution, pure birth process, pure death process, birth and death process, problems.
Branching process: Definition and examples of discrete time branching process, probability generating function, mean and variance, probability of extinction problems.

Books for References
1. Karlin S. and Taylor H.M. (1995): A First Course in Stochastic Process, Academic Press
2. Hoel P.G., Port S.C. and Stone C.J. (1991): Introduction to Stochastic Process, Universal Book Stall.
3. Parzen E. (1962): Stochastic Process, Holden-Day
4. Cinlar E. (1975) : Introduction to Stochastic Processes, Prentice Hall.
5. Adke S.R. and Manjunath S.M. (1984) : An Introduction to Finite Markov Processes, Wiley Eastern.
6. Medli J. (1996) : Stochastic Processes, new Age International (P) Ltd.
7. Ross S.M. (1983) : Stochastic Process, John Wiley.
8. Taylor H.M. and Karlin S. (1999) : Stochastic Modeling, Academic Press.