Choice Based Credit System (CBCS)

KOLHAN UNIVERSITY CHAIBASA

DEPARTMENT OF STATISTICS

UNDERGRADUATE B.SC PROGRAMME

(Courses effective from Academic Year 2017-18)

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses

B.Sc Programme Statistics

CORE COURSES STRUCTURE

Semester	Papers
1	**Core 1: Basic Statistics and Probability**
2	**Core 2: Statistical Methodology**
3	**Core 3: Theory of Statistical Inference**
4	**Core 4: Survey Sampling and Design of Experiments**

DISCIPLINE SPECIFIC ELECTIVE COURSES STRUCTURE

Semester	Papers
5	**DSE 1-(i): Demography**
	DSE 1-(ii): Applied Statistics- I
6	**DSE 2-(i): Applied Statistics- II**
	DSE 2-(ii): Demand Analysis and Linear Regression

Core 1: Basic Statistics and Probability

UNIT I

Concepts of a 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 tables and by diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods).

UNIT II

Measures of location (or central tendency) and dispersion, moments, measures of skewness and kurtosis, cumulants. Bivariate data: Scatter diagram, principle of least-square and fitting of polynomials and exponential curves. Correlation and regression. Karl Pearson coefficient of correlation, Lines of regression, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only).

UNIT III

Random experiment, sample point and sample space, event, algebra of events, Definition of Probability - classical, relative frequency and axiomatic approaches to probability, merits and demerits of these approaches (only general ideas to be given). Theorem on probability, conditional probability, independent events. Baye's theorem and its applications.

REFERENCES:

1. A.M. Goon, M.K. Gupta and B. Dasgupta (2005): *Fundamentals of Statistics*, Vol. I, 8th Ed., World Press, Kolkatta.
2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.
3. R.V. Hogg, A.T. Craig and J.W. Mckean (2005): *Introduction to Mathematical Statistics*, 6th Ed., Pearson Education.
4. A.M. Mood, F.A. Graybill and D.C. Boes (2007): *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw Hill Publication.

PRACTICAL /LAB WORK:

In this practical paper all the practical problems based on the related theory covered in concerned syllabus segment, Viva-Voce and Classroom attendance.

Core 2: Statistical Methodology

UNIT I

Random variables: Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations of random variables and its properties, expectation of random variable and its properties. Moments and cumulants, moment generating function, cumulants generating function and characteristic function. Bivariate probability distributions, marginal and conditional distributions; independence of variates (only general idea to be given). Transformation in univariate and bivariate distributions.

UNIT II

Point (or degenerate), Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, Normal, Uniform, Exponential, Beta and Gamma distributions.

UNIT III

Markov inequality, Chebychev's inequality, WLLN and SLLN: Statements and applications, Central limit theorem (CLT) for i.i.d. variates, and its applications.

REFERENCES:

1. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): *An outline of Statistical Theory* (Vol. I), 4th Ed., World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.
3. R.V. Hogg, A.T. Craig, and J.W. Mckean (2005): *Introduction to Mathematical Statistics*, 6th Ed. Pearson Education.
4. A.M. Mood, F.A. Graybill and D.C. Boes (2007): *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw Hill Publication.
5. V.K. Rohtagi and A.K. Md. E. Saleh (2009): *An Introduction to Probablity and Statistics*, 2nd Edition, John Wiley and Sons.

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Core 3: Theory of Statistical Inference

UNIT I

Definitions of random sample, parameter and statistic, null and alternative hypotheses, simple and composite hypotheses, level of significance and probabilities of Type I and Type II errors, power of a test and critical region. Sampling distribution of a statistic, sampling distribution of sample mean, standard error of sample mean.

UNIT II

Large sample tests for single mean, difference of means, standard deviation and difference of standard deviations. Sampling distributions of chi-sq, t and F: definitions, properties and relationships between them. Tests of Significance based on Chi-square (goodness of fit and independence of attributes), t distribution and F- distribution using classical and p-value approach.

UNIT III

Estimation: Parameter space, sample space, point estimation, requirement of a good estimator, consistency, unbiasedness, efficiency, sufficiency, Minimum variance unbiased estimators. Cramer-Rao inequality: statement and application, Methods of estimation: maximum likelihood, least squares and minimum variance, statement of Rao-Blackwell theorem and Lehmann-Scheffe theorem. Properties of maximum likelihood estimators (illustration). Interval Estimation: confidence intervals for the parameters of normal distribution, confidence intervals for difference of mean and for ratio of variances. Neyman-Pearson lemma and MP test: statements and applications.

REFERENCES:

1. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): *An Outline of Statistical Theory* (Vol. I), 4th Ed., World Press, Kolkata.
2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.
3. R.V. Hogg, A.T. Craig and J.W. Mckean (2005): *Introduction to Mathematical Statistics*, 6th Ed. Pearson Education.

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Core 4: Survey Sampling and Design of Experiments

UNIT I

Sample Surveys: Basic concepts of sample survey: concept of sampling, need for sampling, complete enumeration v/s. sampling, principles of sampling theory, principal steps in a sample surveys, planning and organization of a sample survey, sampling and non-sampling errors.Simple random sampling (srswr and srswor), Stratified random sampling Systematic sampling.

UNIT II

Analysis of variance: one-way and two-way classified data with one observation per cell only. Design of experiments: Principles of Design of experiments, uniformity trails, completely randomized, Randomized block and Latin square designs. Missing plot technique, 2^2 and 2^3 Factorial experiments: construction and analysis.

UNIT III

Indian Official Statistics: Present Official Statistical System in India relating to census of population, agriculture, industrial production, and prices; methods of collection of official statistics, major publications, their reliability and limitations. Agencies responsible for the data collection- C.S.O., N.S.S.O., Office of Registrar General: historical development, main functions and important publications.

REFERENCES:

1. S.C. Gupta and V.K. Kapoor, *Fundamentals of Applied Statistics*, 4th Ed., Sultan Chand and Sons, 2008.
2. D.C. Montgomery (2001): *Designs and Analysis of Experiments*, John Wiley and Sons, New York.
3. P.V. Sukhatme, B.V. Sukhatme, S. Sukhatme and C. Ashok (1984): *Sampling Theory of Surveys with Applications*, Lowa State University Press, Lowa, USA.
4. Guide to current Indian Official Statistics, Central Statistical Office, GOI,New Delhi.
5. http://mospi.nic.in/

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DSE 1-(i): Demography

UNIT I

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

UNIT II

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.

UNIT III

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

REFERENCES:

1. P. Mukhopadhyay (1999): Applied Statistics, Books and Allied (P) Ltd.
2. A.M. Goon, M.K. Gupta and B. Dasgupta (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
3. S. Biswas (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
4. N. Keyfitz and John A. Beckman ( ): Demogrphy through Problems, S-Verlag New york.

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DSE 1-(ii): Applied Statistics- I

UNIT I

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher. Factor reversal and time reversal tests. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

UNIT II

Introduction to times series data, application of time series from various fields. Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves. Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series.

UNIT III

Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend. Ratio to Moving Averages and Link Relative method, Deseasonalization. Random Component: Variate component method.

REFERENCES:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Gupta, S.C. and Kapoor, V. K. (2008): Fundamentals of Applied Statistics, 4th Ed. (reprint), Sultan Chand and Sons.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. Kendall M.G. (1976): Time Series, Charles Griffin.
5. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
6. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied.

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DSE 2-(i): Applied Statistics- II

UNIT I

Quality: Definition, dimensions of quality, historical perspective of quality control and improvements starting from World War II, historical perspective of Quality Gurus and Quality Hall of Fame. Quality system and standards: Introduction to ISO quality standards, Quality registration. Statistical Process Control - Seven tools of SPC, chance and assignable causes of quality variation.

UNIT II

Statistical Control Charts- Construction and Statistical basis of 3-σ Control charts, analysis of patterns on control chart, Control charts for variables: X-bar & R-chart, X-bar & s-chart. Control charts for attributes: np-chart, p-chart, c-chart and u-chart. Comparison between control charts for variables and control charts for attributes.

UNIT III

Acceptance sampling plan: Principle of acceptance sampling plans. Single sampling plan their OC, AQL, LTPD, AOQL, ASN, ATI functions with graphical interpretation, use and interpretation of Dodge and Romig's sampling inspection plan tables.

REFERENCES:

1. Montogomery, D. C. (2009): Introduction to Statistical Quality Control, 6th Edition, Wiley India Pvt. Ltd.
2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
3. Mukhopadhyay, P (2011):Applied Statistics, 2nd edition revised reprint, Books and Allied(P) Ltd.
4. Montogomery, D. C. and Runger, G.C. (2008): Applied Statistics and Probability for Engineers, 3rd Edition reprint, Wiley India Pvt. Ltd.

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DSE 2-(ii): Demand Analysis and Linear Regression

UNIT I

Demand Analysis: Demand function, price and income elasticity of demand, nature of commodities, laws of supply and demand, Income distributions, Pareto – curves of concentration. Utility and Production Functions: utility function, constrained utility maximisation, indifference curves, derivation of demand curve, production function, homogeneous production functions, Isoquant and Isocost curves, Elasticity of substitution, C.E.S. functions, Multiple production by monopolist, discriminating monopolistic form, multiplant form.

UNIT II

Simple Linear Regression Model: Two Variable Case Estimation of model by method of ordinary least squares, properties of estimators, goodness of fit, tests of hypotheses, scaling and units of measurement, confidence intervals, Gauss-Markov theorem and forecasting.

UNIT III

Multiple Linear Regression: OLS Estimation of parameters; properties of OLS estimators, goodness of fit - R^2, partial regression coefficients and testing of hypotheses on parameters (individual and joint).

REFERENCES:

1. Croxton, F.E., Cowden, D.J. and Klein, S. (1982): Applied General Statistics, 3rd Edn. Prentice Hall of India (P) Ltd.
2. Soni, R.S. (1996): Business Mathematics with Application in Business and Economics. Pitamber Publishing Co.
3. Montgomery, D.C., Peck, E.A. and Vining, G. G. (2006) Introduction to Linear Regression Analysis, 4th ed. John Wiley & Sons.

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