U.G STATISTICS (Hons.)

Course structure under

CHOICE BASED CREDIT SYSTEM

FOR

SESSION 2016-2019

BERHAMPUR UNIVERSITY

STATISTICS (HONOURS)

SEMESTER-I

C:1-DESCRIPTIVE STATISTICS-I & LINEAR ALGEBRA

(Credits:6, Theory-4, Practical-2) Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I:

Statistical Methods : Definition & scope of Statistics, concepts of Statistical population and sample, quantitative and qualitative data, attributes, variables,scales of measurement-nominal, ordinal, interval and ratio. Presentation : tabular and graphical including histogram and ogives.

UNIT-II:

Measures of Central Tendency: mathematical andpositional. Measures of Dispersion: range, quartile deviation, standard deviation, coefficient of variation, Moments, absolute moments, skewness and kurtosis, Shephards correction.

UNIT-III:

Permutation & Combination, Binomial Theorem, Logarithmic & Exponential Series, Determinant.

UNIT-IV:

Matrices: types of matrices(orthogonal matrix and idempotent matrix); operation on matrices (including inverse); partitioned matrices; singular and non-singular matrices. Rank of a matrix: row-rank and column-rank; properties of rank; rank of sum and product of matrices.

PRACTICAL

Calculation of different measures of Central tendency, dispersion, skewness and kurtosis.

Calculation of Ist. Four moments from grouped and ungrouped data.

Recommended Books:

Intermediate Algebra by Ghanshyam Samal, Vidyapuri Publication,2007.

A text book of matrices by Shanti Narayan, S. Chand,1962.

Fundamentals of Statistics by S.C Gupta, Himalayan Publishing House, 2014.

Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.

C:2-DESCRIPTIVE STATISTICS-II & CALCULUS

(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks + Mid sem: 15 Marks

UNIT-I:

Bivariate Data : Definition, Curve fitting by the method of least squares (linear, quadratic and exponential), fitting of curves reducible to polynomials by log and inverse transformation.

UNIT-II:

Correlation Coefficient: Scatter diagram, Product moment correlation coefficient and its properties (for grouped and ungrouped data), coefficient of determination, correlation ratio, rank correlation, intra class correlation. Regression Analysis: Concept of regression, fitting of regression lines, regression coefficients and their properties.

UNIT-III:

Function of one variable; limit, continuity and differentiability; successive differentiation; mean value theorem (statement only); maxima and minima.Function of Several Variables: Partial derivatives.

UNIT-IV:

Integral Calculus : Review of Integration (algebraic, trigonometric, logarithmic and exponential functions) and definite integral, Algebra of integration, differentiation under Integral sign.

PRACTICAL

Fitting of 1st., 2nd. degree polynomial and exponential curve.

Calculation of simple correlation coefficient, regression lines, rank correlation coefficient(for grouped and ungrouped data).

Recommended Books:

1. Differential calculus by Das & Mukherjee, U.N Dhar Publication, Kolkatta, 2010.
2. Integral Calculus by Das & Mukherjee, U.N Dhar, Kolkatta, 2010.
3. Fundamentals of Statistics by S.C Gupta, Himalayan Publishing House, 2014.
4. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.
5. Statistical Methods by P.N. Arora, S. Arora & S. Arora, S. Chand, 2014.

SEMESTER-II

C:3-PROBABILITY - I & NUMERICAL ANALYSIS

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Random experiment : trials, sample point and samples space, event, operations of events, concept of mutually exclusive and exhaustive events. Definition of Probability: Classical, relative frequency and axiomatic approach; discrete and continuous probability space, addition law of probability. Multiplication law of probability, conditional probability and independence of events, Bayes theorem and its applications.

UNIT-II:

Difference table. Methods of interpolation: Newtons forward and backward interpolation formulae. Newtons divided difference formula.

UNIT-III:

Lagranges interpolation formulae, inverse interpolation, central difference formula.

UNIT-IV:

Numerical differentiation (Eulers method), Numerical integration: Trapezoidal, Simpsons one-third, three-eighth rules.

Recommended Books:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. An Outline of Statistical Theory, Vol-I, Gun, Gupta & Dasgupta, 4thEdn., World Press, 2003.
3. Numerical Methods by P.Kandasamy, K. Thilagavathy & K.Gunavathi, S. Chand, 2012.
4. Numerical Methods & Applications by E. Ward Cheney & David R. Kincaid, Cengage Publication, 2010.
6. Numerical Analysis byGoel and Mittal, PragatiPrakashan, ND, 2008.

C:4-PROBABILITY-II & DESCRIPTIVE STATISTICS-III

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Random variables: Definition, properties, probability mass function, probability density function; distribution function, Bivariate random variables, joint, marginal and conditional distributions. Mathematical expectation of a random variable and its properties, Mean and variance of a random variables, probability generating function, moment generating function and cumulant generating function. Conditional expectation and conditional variance.

UNIT-II:

Characteristic function (simple applications), uniqueness theorem, convergence of random variables, convergence in probability, convergence in distribution. Hally-Bray theorem (without proof) and its application.

UNIT-III:

Multivariate Data: Multiple and Partial correlations (Yules Notation) and plane of regression (three variables only). Properties of residuals, coefficient of multiple and partial correlation and their properties.

UNIT-IV:

Analysis of categorical Data : Consistency of categorical data, independence and association of attributes. Yules coefficient, coefficient of colligation.

Recommended Books:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Mathematical Statistics by J.N. Kapoor & H.C. Saxena, S. Chand, 2011.
3. An Outline of Statistical Theory, Vol-I, Gun, Gupta & Dasgupta, 4th Edn., World Press, 2003.

SEMESTER-III

C:5-PROBABILITY DISTRIBUTIONS

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Discrete probability distributions: Uniform, Bernoulli, Binomial, Poisson, Negative Binomial, Geometric, Hyper geometric and their properties.

UNIT-II:

Continuous probability distributions: Uniform, Normal, Beta, Gamma, Exponential, Cauchy and their properties.

UNIT-III:

Exact sampling distributions: Chi-square, Students t, Fishers t and Snedeckors F and relationship between t ,F and x^2 .

UNIT-IV:

Weak law of large numbers: Bernoullis WLLN, Chebyshevs inequality, Chebychevs WLLN, Poissons Central Limit Theorem.

Recommended Books:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.
2. An Outline of Statistical Theory, Vol-I, Gun, Gupta & Dasgupta, 4thEdn., World Press, 2003.

C:6-SAMPLING DISTRIBUTION & BASICS OF COMPUTER

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Concept of population, sample, parameter, statistic and sampling distribution; standard error, standard error of moments, distribution of sample mean and variance from normal distribution.

UNIT-II:

Tests of significance based on large sample: the normal test of significance (Z-test) for both one-sample and two-sample problems for mean, proportion and standard deviation.

UNIT-III:

Small sample tests: Tests of significance based on exact sampling distributions, i.e. x^2,t and F distributions.

UNIT-IV:

Introduction to world of computer, The system unit: Processing & Memory, Storage-Storage Systems: Magnetic and Optical Disks, Input and Output, Key board, Pointing Devices, Scanners, Audio Inputs & Output, Display Devices. Operating Systems: DOS, WINDOWS, LINUX, MAC.

Recommended Books:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.
2. Statistical Methods:- P.N. Arora, S. Arora & S. Arora, S. Chand, 2014.
3. Statistical methods by S.P. Gupta, Himalayan Publication, Mumbai, 2013.

4. Fundamentals of Computers by Morles & Parker,Cengage publication,2013.
5. Computer Fundamentals and office by Sanjay Saxena and Rajneesh Agrawal, Vikas Publication,2014.

C:7-THEORY OF ESTIMATION

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Point Estimation: Introduction, Properties of Estimator: unbiasedness, consistency, efficiency and sufficiency.

UNIT-II:

Minimum Variance Unbiased Estimation, Rao-Cramer inequality, Rao-Blackwell theorem and applications.

UNIT-III:

Methods of Estimation: Method of maximum likelihood, properties of MLE. Method of least squares, method of moments, method of minimum variance.

UNIT-IV:

Interval Estimation: Concepts of confidence interval and confidence coefficient, confidence intervals for the parameters of univariate normal distribution. Theory of linear estimation, concept of Gauss Markov linear model (full rank case), Estimation of parameters in linear models.

Recommended Books:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. An Outline of Statistical theory (Vol-II) Goon, Gupta and Dasgupta, World Press, 2007.
3. Fundamentals of applied Statistics S.C. Gupta and V.K. Kapoor, Sultan Chand, 2013.

SEMESTER-IV

C:8-THEORY OF ESTIMATION

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Statistical Hypotheses: Simple and composite, statistical tests, critical region, type-I and type-II error, size and power of a test, definition of Most powerful (MP), Uniformly Most Powerful(UMP) and Uniformly Most Powerful Unbiased (UMPU) tests.

UNIT-II:

Neyman-Pearson lemma and its applications in testing of hypothesis based on Binomial, Poisson and Normal distributions.

UNIT-III:

Tests of composite hypothesis: likelihood ratio test and problems based on LR test.

UNIT-IV:

Non-parametric inference: Introduction, merits and demerits, one-sample sign test, paired-sample sign test. Wilcoxon signed-rank test.Wilcoxon paired sample sign ranked test. U statistic, Mann-Whitney U-test, Kolmogorov-Smirnov one sample and two sample tests.

Recommended Books:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Outline of Statistical theory (Vol-II) Goon, Gupta & Dasgupta, World Press, 2008.
3. Statistical Inference: Testing of Hypothesis by Srivastava & Srivastava, Oscar,2009.

C:9-SAMPLING THEORY

(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I:

Population and sample, sampling versus census, steps involved in sample surveys, principles of sample survey, Advantages and disadvantages of sampling, Sampling and non-sampling errors.

UNIT-II:

Types of sampling: Non-probability, Probability & Mixed methods, Simple Random Sampling: SR-SWR & SRSWOR, Drawing of random sample by different methods, estimation of mean and variance.

UNIT-III:

Stratified Random Sampling: Advantages & disadvantages, uses, allocation of sample sizes into various strata: proportional and optimum, estimation of mean, total and variance of the estimate.

UNIT-IV:

Systematic sampling: Advantages and disadvantages, uses, drawing of systematic samples, estimation of mean and variance. systematic sampling versus stratified random sampling, systematic sampling when the population consists of a linear trend.

PRACTICAL

1. Problems on SRS, Stratified R.S, systemic sampling.

Recommended Books:

1. Fundamentals of Applied Statistics-S.C. Gupta and V.K. Kapoor, Sultan Chand, 2013.
2. Sampling Techniques W.G. Cochran, Wiley & Sons, 2007.
3. Sampling Theory of Survey with Applications by P.V. Sukhatme, B.V. Sukhatme, S.Sukhatme and C.Asok, ISAS, New Delhi, 1984.

C:10-INDEX NUMBER & LINEAR PROGRAMMING

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Index numbers: Introduction, uses & types. Base year and current year, price relatives and quantity relatives. Problems involved in construction of index number. Unweighted and weighted index number, Laspayers, PaaschesDorbish-Browley,Fishers ideal index number.

UNIT-II:

Criteria of good index number: Unit, Time Reversal, Factor Reversal & Circular tests, cost of living index number, its construction: Aggregate Expenditure & Family Budget method and uses, fixed base and chain base index numbers, base shifting, splicing and deflating.

UNIT-III:

Procedure of solving LPP by graphical method, Definition of Feasible solution, basic feasible solution, Slack and surplus variables, simplex method Big M method.

UNIT-IV:

Duality; Primal dual conversion, Dual-simplex method, advantages of duality, game theory concept, two person zero-sum game.

Recommended Books:

1. Operations Research by S.Kalavathy, Vikas, 2009.
2. Introduction to Operations Research by Prem Kumar Gupta, D.S. Hira and Aarti Kamboj, S.Chand and Company, 2012.
3. Operations Research by Anand Sharma, Himalayan Publishing House, 2014.
4. Operations Research by P.K Tripathy, Kalyani Publications, 1997.

SEMESTER-V

C:11-STATISTICAL QUALITY CONTROL & OFFICIAL STATISTICS

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Meaning and uses of Statistical Quality control(SQC), control chart variables, Process and product control, chance and assignable causes of variation, 3- sigma control limits, X R and *a* charts. Control chart for attributes, p-chart, d-chart, c-chart and their interpretations

UNIT-II:

Natural tolerance limit and specification limit, acceptance sampling by attributes, AQL, LTPD, AOQL & ASN consumers risk and producers risk, O.C. curve. Idea about single and double sampling plans.

UNIT-III:

Present official Statistical System in India. Methods of collection of official statistics, their reliability and limitations.

UNIT-IV:

Central Statistical organization-CSO & NSSO: their functions and publications. State Statistical Organizations: functions and publications.
Idea about population statistics, Agricultural, Yield and Area statistics.

Recommended Books:

1. Fundamentals of applied Statistics S.C. Gupta and V.K. Kapoor, Sultan Chand, 2013.
2. Fundamentals of Statistics (Vol-II)-Goon, Gupta and Dasgupta, World Press, 2007.
3. Indian Official Statistical System: M.R. Saluja, Publication Society, 2006.

C:12-VITAL STATISTICS

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Introduction to Vital Statistics, Different Vital events, rates and ratio of vital events. Vital Statistics in the study of population trend, Uses of Vital statistics. Measurement of mortality : Crude death rate, age-specific death rates, IMR, standardized death rate, Direct and indirect method of standardization and uses.

UNIT-II:

Mortality table or Life table, its uses, columns of life table, assumptions, and construction of lifetable, Abridged life table (Reed Merell). Measurement of fertility: crude birth rate, general fertility rate, age-specific birth rate, total fertility rate, gross reproduction rate, net reproduction rate.

UNIT-III:

Population Census: Methods of census, salient features, its uses and problems, registration method, sample surveys, sources of demographic data.

UNIT-IV:

Population Estimation and projection, need and uses, methods of population estimation & projection.

Recommended Books:

1. Fundamentals of Applied Statistics, S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Indian Official Statistical System: M.R. Saluja, Publication Society, 2006.
3. Statistical System in India: Asthna & Srivastav, S. Chand, 2009.
4. Techniques of Demographic analysis, K.B. Pathak and F.Ram, Himalaya publication.

SEMESTER-VI

C:13-DESIGN OF EXPERIMENTS
(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 marks + Mid Sem: 15 Marks

UNIT-I:

Analysis of variance: one way and two way classified data, Design of Experiments: Introduction, Experimental units and errors, uniformity trial. Efficiency of design. Basic principles of a design. Randomization, Replication and local control.

UNIT-II:

Completely Randomised Design, Layout and complete analysis of CRD. Advantages and uses. Randomized Block Design, Layout and complete analysis, Missing plot technique in RBD with analysis. Efficiency of RBD, with respect to CRD . Advantages and uses.

UNIT-III:

Latin square Design, and its analysis Estimation of missing value in LSD and analysis. Comparison of efficiency with RBD and CRD.

UNIT-IV:

Factorial Experiments: Introduction, advantages & disadvantages, main and interaction effects, Yates method of computing factorial effect totals. Analysis of 2^2, 2^3 and 2^4 factorial design.

PRACTICAL

1. Analysis of CRD, RBD and LSD.
2. One Missing plot technique in RBD, LSD with analysis.
3. Analysis of 2 and 2 factorial experiments.
4. Confounding in 2 and 2 factorial experiment.

Recommended Books:

1. Fundamentals of applied Statistics S.C. Gupta and V.K. Kapoor, Sultan Chand, 2012.
2. Design and Analysis of Experiments by Das and Giri, Wiley Eastern, ND, 200.
3. Fundamentals of Statistics (Vol-II)-Goon, Gupta and Dasgupta, World Press, 2007.

C:14-STATISTICS FOR PUBLIC POLICY

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Statistics in Psychology and Education: Scaling procedure. Reliability and validity of test scores. Intelligence test and Intelligence Quotient.

UNIT-II:

Demand analysis: laws of demand and supply, price elasticity of demand and supply, partial and cross elasticity of demand.

UNIT-III:

Estimating Elasticity: Types of data, required, Leontief and Pigue method, Engels law and Engels curve, Pareto law of income distribution.

UNIT-IV:

Concept of national income and social accounting- measurement of national income, circular flow of income in two, three and far-factor economy, different forms of national income accounting.

Recommended Books:

1. Macroeconomics: Theory and Policy, H.L. Ahuja, S. Chand Publications.

2. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2014.

DISCIPLINE SPECIFIC ELECTIVE (DSE)

For the Discipline Specific Elective (DSE), a student has to choose any three papers (STAT-DSE-501, STAT-DSE-502, STAT-DSE-601) from the following six papers (two papers in Fifth semester and one paper in Sixth Semester) and a project work (STAT-DSE-602) in Sixth Semester.

1. Time Series Analysis.
2. Biostatistics.
3. Actuarial Statistics.
4. Basic Econometrics.

SEMESTER-V

1. TIME SERIES ANALYSIS

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Time Series: Introduction to time series data and application in various fields, Components of time series, Methods of measuring secular trend: graphic, semi-average, Moving average method.

UNIT-II:

Estimating trend by Iterated averages and Spencers 15-point and 21-point formula. Measurement of trend by least squares method: by fitting Polynomials of 1st & 2nd Degree, exponential, modified exponential, logistic, Gompertz curve.

UNIT-III:

Measurement of seasonal fluctuations: Simple average, Ratio-to-trend, Ratio-to-moving average & Link relatives method.

UNIT-IV:

Measurement of cyclic component: Harmonic analysis. Measurement of irregular variation (variate difference method), effect of moving averages on cyclical and random components of a time series.

Recommended Books:

1. Fundamentals of Applied Statisticsby S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Fundamentals of Statistics, Voll-II, Gun, Gupta & Dasgupta, World Press, 2007.

2. BIO-STATISTICS

(Credits:6)
Lectures: 60
Max. Marks:100(End Sem: 80 Marks + Mid Sem : 20 Marks)

UNIT-I:

Bioassay: The purpose and structure of biological assay. Types of biological assays, Direct assays, Ratio estimates, asymptotic distributions: Fellers theorem. Regression approach to estimating dose response. Logit and probit approach.

UNIT-II:

Statistical Genetics: Basic terminology of genetics. Frequencies of genes and genotypes. Mendles law, Hardy-Weinberg equilibrium, mating frequencies estimation, allele frequency.

UNIT-III:

Reliability: Introduction, Hazard function, Bath tub failure rate. Exponential distribution as life model, its memory-less property.Reliability function and its estimation.System reliability-series and parallel.

UNIT-IV:

Survival Analysis: Survival function and hazard rates. Types of censoring and likehood in these cases. Life time distributions-Exponential, Gamma, Weibull, Longnormal.

Recommended Books:

1. Statistical Techniques in Bioassay ByZ.Govindarangilu, Karger Publishers & Panther publishers (2000).
2. A course in Mathematical and Statistical ecology-By Anil Gore and S.A. Paranjape Kulwer, Academic Publishers(2000).
3. Foundations of Epidemiology By Abraham, M. Lilienfeld Oxford University Press.
4. Reliability Engineering By L.S. Srinath, Affiliated East-West Press.

3. ACTUARIAL STATISTICS

(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks+ Mid Sem: 15 Marks

UNIT-I:

Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future life time, force of mortality.

UNIT-II:

Life table and its relation with survival function examples, assumptions of fractional ages, some analytical laws of mortality. Multiple life functions, joint life and last survivor status, insurance and annuity benefits, evaluation for special mortality laws.

UNIT-III:

Elements of compound interest, life annuities; single payment, continuous life annuities, discrete life annuities.

UNIT-IV:

Net premiums: continuous and discrete premiums, true monthly payment premiums, apportionate premiums, commutation functions and accumulation type benefits.

PRACTICAL

1. Computation of values of utility function.
2. Computation of various components of life table.
3. Construction of multiple discernment table.

4. Determination of distribution function, survival function and force of mortality.
5. Computation of discrete and continuous net premiums.

Recommended Books:

1. Analysis of mortality and other Actuarial Statistics By Benjamin, B. and Pollard, J.H. (1980).
2. Actuarial Mathematics By N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt, Society of Actuaries, Ithaca Illious, USA (1986).

4. BASIC ECONOMETRICS

(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I:

What is Econometrics? Methodology of econometrics, statement of theory or hypothesis, specification of the mathematical and econometric models of consumption, estimation of the econometric model, hypothesis testing, forecasting or prediction, use of the model for control or policy purpose.

UNIT-II:

The modern interpretation of the term regression, Statistical Vs deterministic relationships, regression Vs causation and correlation, nature and sources of data for econometric analysis, accuracy of data.

UNIT-III:

Two-variable regression analysis: Some basic ideas, a hypothetical example concept of population regression function (PRF), meaning of the term linear, linearity in the variable and parameters, stochastic specification of PRF, significance of the stochastic disturbance, sample regression function.

UNIT-IV:

Two-variable regression model: Problem of estimation method of ordinary least squares. Classical linear regression model: Assumptions, how realistic are these assumptions, precision or standard errors of least-squares estimates: Proportion of least-squares estimators: Gauss-Markov theorem, Coefficient of determination r^1 : A measure of gardness of fit.

PRACTICAL

1. Estimation of the econometric model.
2. Computation of sample regression function.
3. Computation of coefficient of determination r2, its interpretation.

Recommended Books:

1. Basic Econometrics By Damodar N. Gujurati, Indian Edition.
2. Econometric Methods By J. Johnston, McGraw Hills International Book company.

SEMESTER-VI

PROJECT
EXTERNAL ASSESSMANT
(Credits:6)
Max. Marks : 100

The project work shall be spread over the whole semester. A project may be undertaken by the students with the consultation of the faculties. However, the project report shall be submitted by each member of the group separately for evaluation. A project report shall clearly state the problem addressed, the methodology adopted, the assumptions and the hypotheses formulated, any previous reference to the study undertaken, statistical analyses performed and the broad conclusion drawn.

INTERNAL ASSESSMANT

The candidate is required to present the synopsis of his/her project work before the teachers of the department.

SEMESTER-I

GE-1: STATISTICAL METHODS-I
(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I:

Ideas about types of data, collection, classification and tabulation of data. Frequency distributions: graphic and diagrammatic representation of data.

UNIT-II:

Measures of central tendency: arithmetic mean, geometric mean & harmonic mean their properties & applications. Median & mode & other partition values: quartiles, deciles, percentiles and graphic presentation.

Measures of dispersion: range, quartile deviation, mean deviation, standard deviation & variance, coefficient of variation. Moments, skewness and kurtosis.

UNIT-III:

Bivariate data: scatter diagram, curve fitting by method of least squares(straight line and second degree), product moment correlation coefficient and its properties, coefficient of rank correlation.

UNIT-IV:

Concept of regression, fitting of regression lines, regression coefficients, their properties, angle between two regression lines.

PRACTICAL

1. Computation of different measures of central tendency & dispersion.
3. Curve fitting by least squares method.
4. Computation of correlation Coefficient.
5. Computation of rank correlation.
6. Fitting of Regression lines.

Recommended Books:

1. Fundamentals of Statistics by S.C Gupta, Himalayan Publishing House, 2014.
2. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.

SEMESTER-II

GE-2: APPLIED STATISTICS

(Credits:6, Theory-4, Practical-2)
Lectures: 60 (Theory:40, Practical:20)
Max. Marks:100(Theory:75, Practical:25)
End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I:

Random experiment : trials, sample point and samples space, event, operations of events, concept of mutually exclusive and exhaustive events.

Definition of Probability: Classical, relative frequency and axiomatic approach; discrete and continuous probability space, addition law of probability, Multiplication law of probability.

UNIT-II:

Time Series: Introduction to time series data and application in various fields, Components of time series, Methods of measuring secular trend: graphic, semi-average, Moving average method.

UNIT-III:

Estimating trend by Iterated averages. Measurement of trend by least squares method: by fitting Polynomials of 1st & 2nd Degree, exponential, modified exponential, logistic, Gompertz curve.

UNIT-IV:

Index numbers: Introduction, uses & types. Base year and current year, price relatives and quantity relatives . Problems involved in construction of index number. Unweighted and weighted index number, Laspayers, Paasches Dorbish-Browley, Fishers ideal index number. Criteria of good index number: Unit, Time Reversal, Factor Reversal & Circular tests, cost of living index number, its construction.

PRACTICAL

1. Fitting of Binomial & Poisson distribution.
2. Determination of area under Normal Probability curve.

Recommended Books:

1. Fundamentals of Applied Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Fundamentals of Statistics by S.C Gupta, Himalayan Publishing House, 2014.

U.G STATISTICS COURSE (REGULAR)

Structure under
CHOICE BASED CREDIT SYSTEM

FOR
SESSION 2016-2019

BERHAMPUR UNIVERSITY

SEMESTER-I

DSC-ST-A: STATISTICAL METHODS-I

(Credits: 6, Theory: 4, Practical: 2)

Max. Marks: 100 (Theory: 75, Practical: 25)

End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I

Ideas about types of data, collection and classification of data, tabulation of data. Frequency distributions: graphic and diagrammatic representation of data.

UNIT-II

Analysis of Quantitative Data: Concepts of central tendency, dispersion and relative dispersion; moments, skewness and kurtosis and their measures including those based on quartiles and moments.

UNIT-III

Bivariate Data: Scatter diagram, curve fitting by the method of least squares (linear and quadratic), fitting of curves reducible to polynomials by log and inverse transformation.

UNIT-IV

Correlation Coefficient: Product moment correlation coefficient and its properties, coefficient of determination, correlation ratio, rank correlation.

UNIT-V

Regression Analysis: Concept of regression, fitting of regression lines, regression coefficients and their properties.

BOOKS RECOMMENDED:

1. Fundamentals of Statistics by S.C Gupta, Himalayan Publishing House, 2014.
2. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.
3. Statistical Methods by P.N. Arora, S. Arora & S. Arora, S. Chand, 2014.

PRACTICAL: DSC-ST-A

1. Computation of mean, median, mode, geometric mean and harmonic mean.
2. Measures of dispersion, moments, skewness & Kurtosis.
3. Fitting of curves by least-squares method.
4. Computation of correlation coefficient, rank correlation coefficient.
5. Fitting of regression lines.

SEMESTER-II

DSC-ST-B: PROBABILITY AND PROBABILITY DISTRIBUTIONS
(Credits: 6, Theory: 4, Practical: 2)
Max. Marks: 100 (Theory: 75, Practical: 25)
End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I

Random experiment: trials, sample point and samples space, events, operations of events, concepts of mutually exclusive and exhaustive events. Definition of Probability : Classical, relative frequency and axiomatic approach; discrete and continuous probability space, addition law of probability.

UNIT-II

Multiplication laws of probability, conditional probability and independence of events, Bayes theorem and its applications.

UNIT-III

Random variables; probability mass function, probability density function; distribution function, joint, marginal and conditional distributions.

UNIT-IV

Mathematical Expectation of a random variable and its properties, moment generating function, cumulant generating function and probability generating function.

UNIT-V

Discrete probability distributions: Uniform, Bernoulli, Binomial, Poisson. Continuous probability distributions: continuous uniform, Normal and Gamma.

PRACTICAL: DSC-ST-B

1. Fitting of binomial distribution.
2. Fitting of poisson distribution.
3. Computation of areas under normal probability curve.

BOOKS RECOMMENDED:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.
2. Probability and Statistics by Purna Chandra Biswal, PHI EEE, 2007.

SEMESTER-III

DSC-ST-C: STATISTICAL METHODS-II & SAMPLING

(Credits: 6, Theory: 4, Practical: 2)

Max. Marks: 100 (Theory: 75, Practical: 25)

End Sem : 60 Marks + Mid Sem: 15 Marks

UNIT-I

Concept of population, sample, parameter, statistic and sampling distribution; standard error Tests of significance based on large samples (Z-test).

UNIT-II

Concepts of x, t and F distributions and tests of significance based on x, t and F distributions.

UNIT-III Analysis of categorical Data: Consistency of categorical data, independence and association of attributes.

UNIT-IV

Population and sample, sampling versus census, steps involved in sample surveys, principles of sample survey, random sampling versus non-random sampling, sampling and non-sampling errors.

UNIT-V

Simple Random Sampling: Drawing of random sample by different methods, SRSWR & SRSWOR, estimation of mean and variance. Stratified Random Sampling: Advantages & disadvantages, uses, estimation of mean and Variance only.

PRACTICAL: DSC-ST-C

1. Tests of significance based on large samples (Z-test).
2. Tests based on x, t and F distributions.
3. Associations of attributes.
4. Estimation of mean and variance in SRS and stratified sampling.

BOOKS RECOMMENDED:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2013.
2. Statistical methods by S.P. Gupta, Himalayan Publication, Mumbai, 2013.
3. Fundamentals of Applied Statistics by S.C. Gupta and V.K. Kapoor.

SEMESTER-IV

DSC-ST-D:DESIGN AND ANALYSIS OF EXPERIMENT, OPERATIONS RESEARCH

(Credits: 6, Theory: 4, Practical: 2)

Max. Marks: 100 (Theory: 75, Practical: 25)

End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I

Analysis of Variance: Introduction, one-way & two-way classifications (with one observation per cell) with fixed effect model and their analysis.

UNIT-II

Basic principles of experimental design: replication, randomization and local control Completely Randomized Design, Randomized Block Design.

UNIT-III

Introduction, definition, scope of Operations Research, Linear programming problems formulation, procedure of solving LPP by graphical method.

UNIT-IV

Definition of feasible solution, basic feasible solution, slack, surplus & artificial variables, simplex method, its algorithm & solution.

UNIT-V

Scheduling by PERT and CPM: Phases of project management, Difference between PERT and CPM, network construction, Computation of different times: EST, LST, Slack and Float time, Critical path.

PRACTICAL: DSC-ST-D

1. Analysis of variance in case of one-way and two-way(one observation per cell) classified data.
2. Completely randomized design, randomized block design, estimation of one missing value in RBD.
3. Solution of LPP by graphical method & simplex method.
4. Computation of trend values by graphic, semi-averages moving averages and least-squares method.

BOOKS RECOMMENDED:

1. Fundamentals of Applied Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand.
2. Operations Research by R.K. Gupta, Krishna Prakashan

DISCIPLINE SPECIFIC ELECTIVE

For DSE-(ST-A) and DSE-(ST-B), one has to choose any two (one for each semester) from the following three papers:

1. Time Series Analysis
2. Statistical Quality Control
3. Vital Statistics

DSE-ST: Time Series Analysis

Credits: 6, Theory: 4, Practical: 2)

Max. Marks: 100 (Theory: 75, Practical: 25)

End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I

Time Series: Introduction to time series data and application in various fields, Components of time series, Mathematical Models, Methods of measuring secular trend: graphic, semi-average, Moving average method.

UNIT-II

Measurement of trend by least squares method: by fitting Polynomials of 1st & 2nd Degree, exponential, modified exponential, logistic, Gompertz curve.

UNIT-III

Measurement of seasonal fluctuations: Simple average, Ratio-to-trend, Ratio-to-moving average & Link relatives method.

UNIT-IV

Measurement of cyclic component: Harmonic analysis. Measurement of irregular variation (variate difference method), effect of moving averages on cyclical and random components of a time series.

UNIT-V

Different schemes which account for oscillations in a stationary time series.Auto regressive series of first and second order, Serial correlation and correlogram.

PRACTICAL

1.Measurement of Trend and seasonal fluctuations.

2. Problems on Spencers 15-point and 21-point formula.

BOOKS RECOMMENDED:

1. Fundamentals of Applied Statisticsby S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Fundamentals of Statistics, Voll-II, Gun, Gupta & Dasgupta, World Press, 2007.

DSE-ST: Statistical Quality Control

Credits: 6, Theory: 4, Practical: 2)

Max. Marks: 100 (Theory: 75, Practical: 25)

End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I

Types of quality measure, rational sub-groups and the techniques of control charts, 3-sigma control limits and probability limits, Control charts for variables (Mean, S.D. and Range).

UNIT-II

Control charts for attributes, two types of control charts, Natural tolerance limits and specification limits, Modified control limits.

UNIT-III

Process control and Product control, advantages of process control, Sampling inspection by attributes: single sampling Plans.

UNIT-IV

Double sampling plans, Five different characteristic curves and their importance, sequential sampling inspection plans, comparison of three types of plans.

UNIT-V

Acceptance Sampling: comments on Dodge and Romigs schemes. Sampling inspection by variables: underlying principle, variables inspection with known standard deviation and variables inspection with unknown standard deviation.

PRACTICAL

1. Measurement of secular trend: Fitting of different types of curves by least square method.
2. Measurement of seasonal fluctuations.
3. Serial correlation and Correlogram.
4. Control charts for variables and attributes.
5. OC, ASN, ATI, LTPD, AOQL curves.

BOOKS RECOMMENDED:

1. Fundamentals of Applied Statistics by S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Fundamentals of Statistics, Voll-II, Gun, Gupta & Dasgupta, World Press, 2007.

DSE-ST: Vital Statistics

Credits: 6, Theory: 4, Practical: 2)

Max. Marks: 100 (Theory: 75, Practical: 25)

End Sem: 60 Marks + Mid Sem: 15 Marks

UNIT-I

Introduction to Vital Statistics, Different Vital events, rates and ratio of vital events. Vital Statistics in the study of population trend, Uses of Vital statistics.

UNIT-II

Population Census: Methods of census, salient features, its uses and problems, registration method, sample surveys, sources of demographic data.

UNIT-III

Measurement of mortality: Crude death rate, age-specific death rates, IMR, standardized death rate, Direct and indirect method of standardisation and uses.

UNIT-IV

Mortality table or Life table, its uses, columns of life table, assumptions, and construction of life table, Abridged life table (Reed Merell).

UNIT-V

Measurement of fertility: crude birth rate, general fertility rate, age-specific birth rate, total fertility rate, gross reproduction rate, net reproduction rate.

PRACTICAL

1. Calculation of different measures of mortality and fertility.
2. Construction of Life table.

BOOKS RECOMMENDED:

1. Fundamentals of Applied Statistics, S.C. Gupta & V.K. Kapoor, Sultan Chand, 2012.
2. Indian Official Statistical System: M.R. Saluja, Publication Society, 2006.
3. Statistical System in India: Asthna & Srivastav, S. Chand, 2009.