KOLHAN UNIVERSITY CHAIBASA

DEPARTMENT OF STATISTICS

U.G. SYLLABUS

HONOURS COURSE

(Courses effective from Academic Year 2017-18)

Updated june-2020

Proposed Scheme for Choice Based Credit System in B.Sc. Honours (Statistics)

Sem	CC	Core Course (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Discipline Specific Elective DSE (4)	Generic Elective (GE) (4)
I	CC-1	Descriptive Statistics (Theory + Practical)	(English/MIL Communication) /Environmental Science			GE-1
	CC-2	Calculus				
II	CC-3	Probability and Prob. Distributions (Theory + Practical)	Environmental Science/ (English/MIL Communication)			GE-2
	CC-4	Algebra				
III	CC-5	Sampling Distributions (Theory + Practical)		SEC-1		GE-3
	CC-6	Survey Sampling & Indian Official Statistics (Theory + Practical)				
	CC-7	Mathematical Analysis				
IV	CC-8	Statistical Inference (Theory + Practical)		SEC-2		GE-4
	CC-9	Linear Models (Theory + Practical)				
	CC-10	Statistical Quality Control (Theory + Practical)				
V	CC-11	Stochastic Processes and Queuing Theory (Theory + Practical)			STAT-DSE-1	
	CC-12	Statistical Computing Using C / C++ /R Programming (Theory + Practical)			STAT-DSE-2	
VI	CC-13	Design of Experiments (Theory + Practical)			STAT-DSE-3	
	CC-14	Multivariate Analysis and Nonparametric Methods (Theory + Practical)			STAT-DSE-4	

Core Papers (Credit: 6 each) (14 papers)

STAT-CC-1   Descriptive Statistics (Theory+ Practical)

STAT CC-2   Calculus (Theory+ Internal)

STAT-CC-3   Probability and Probability Distributions (Theory+ Practical)

STAT CC-4   Algebra (Theory+ Internal)

STAT-CC-5   Sampling Distributions (Theory+ Practical)

STAT-CC-6   Survey Sampling and Indian Official Statistics (Theory+ Practical)

STAT CC-7   Mathematical Analysis (Theory+ Internal)

STAT-CC-8   Statistical Inference (Theory+ Practical)

STAT-CC-9   Linear Models (Theory+ Practical)

STAT-CC-10   Statistical Quality Control (Theory+ Practical)

STAT-CC-11   Stochastic Processes and Queuing Theory (Theory+ Practical)

STAT-CC-12   Statistical Computing Using C/C++ Programming (Theory+ Practical)

STAT-CC-13   Design of Experiments (Theory+ Practical)

STAT-CC-14   Multivariate Analysis and Nonparametric Methods (Theory+ Practical)

Discipline Specific Elective Papers (Credit: 6 each)

DSE-1. Operations Research(Theory+ Practical) / Econometrics(Theory+ Practical)

DSE-2. Time Series Analysis(Theory+ Practical) / Financial Statistics(Theory+ Practical)

DSE-3. Demography and Vital Statistics (Theory+ Practical) / Actuarial Statistics(Theory+ Practical)

DSE-4. Project Work (Sixth Semester)

Skill Enhancement Course (Credit: 2 each) (2 papers to be selected)

1. Statistical-Data Analysis Using Software Packages

2. Statistical Data Analysis Using R

3. Statistical Techniques for Research Methods

4. Data Base Management Systems

STAT-CC-1- Descriptive Statistics

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurementnominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

UNIT II

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.

UNIT III

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

UNIT IV

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's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
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.

STAT-CC-1- Descriptive Statistics

PRACTICAL /LAB WORK:

List of Practical

1. Graphical representation of data.

2. Problems based on measures of central tendency.

3. Problems based on measures of dispersion.

4. Problems based on combined mean and variance and coefficient of variation.

5. Problems based on moments, skewness and kurtosis.

6. Fitting of polynomials, exponential curves.

7. Karl Pearson correlation coefficient.

8. Correlation coefficient for a bivariate frequency distribution.

9. Lines of regression, angle between lines and estimated values of variables.

10. Spearman rank correlation with and without ties.

11. Partial and multiple correlations.

12. Planes of regression and variances of residuals for given simple correlations.

13. Planes of regression and variances of residuals for raw data.

14. Calculate price and quantity index numbers using simple and weighted average of price relatives.

15. To calculate the Chain Base index numbers.

16. To calculate consumer price index number.

STAT CC-2 – Calculus

Marks: 100 (Theory: 70 Tutorial/Internal: 30)   **Credit 6**

UNIT I

Differential Calculus**:** Limits of function, continuous functions, properties of continuous functions, partial differentiation and total differentiation. Indeterminate forms: L-Hospital's rule, Leibnitz rule for successive differentiation. Euler's theorem on homogeneous functions. Maxima and minima of functions of one and two variables, constrained optimization techniques (with Lagrange multiplier) along with some problems. Jacobian, concavity and convexity, points of inflexion of function, singular points.

UNIT II

Integral Calculus**:** Review of integration and definite integral. Differentiation under integral sign, double integral, change of order of integration, transformation of variables. Beta and Gamma functions: properties and relationship between them.

UNIT III

Differential Equations**:** Exact differential equations, Integrating factors, change of variables, Total differential equations, Differential equations of first order and first degree, Differential equations of first order but not of first degree, Equations solvable for x, y, q, Equations of the first degree in x and y, Clairaut's equations. Higher Order Differential Equations**:** Linear differential equations of order n, Homogeneous and non-homogeneous linear differential equations of order n with constant coefficients.

UNIT IV

Formation and solution of simple partial differential equations. Linear partial differential equations of first order. Non-linear partial differential equation of first order and their different forms. Charpit's method. Homogeneous & Non-homogeneous linear partial differential equations with constant coefficients. Different cases for complimentary functions and particular integrals.

SUGGESTED READINGS:

1. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad (14th Edition - 1997).
2. Gorakh Prasad: Integral Calculus, PothishalaPvt. Ltd., Allahabad (14th Edition -2000).
3. Zafar Ahsan: Differential Equations and their Applications, Prentice-Hall of India Pvt. Ltd., New Delhi (2nd Edition -2004).
4. Piskunov, N: Differential and Integral Calculus, Peace Publishers, Moscow.

PRACTICAL /LAB WORK:

Tutorial/Internal

STAT-CC-3- Probability and Probability Distributions

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

UNIT II

Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations with illustrations.

UNIT III

Mathematical Expectation and Generating Functions: Expectation of single and bivariate random variables and its properties. Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations.

UNIT IV

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases.

SUGGESTED READING:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi

STAT-CC-3- Probability and Probability Distributions

PRACTICAL /LAB WORK

List of Practical

1. Fitting of binomial distributions for n and p = q = ½.

2. Fitting of binomial distributions for given n and p.

3. Fitting of binomial distributions after computing mean and variance.

4. Fitting of Poisson distributions for given value of lambda.

5. Fitting of Poisson distributions after computing mean.

6. Fitting of negative binomial.

7. Fitting of suitable distribution.

8. Application problems based on binomial distribution.

9. Application problems based on Poisson distribution.

10. Application problems based on negative binomial distribution.

11. Problems based on area property of normal distribution.

12. To find the ordinate for a given area for normal distribution.

13. Application based problems using normal distribution.

14. Fitting of normal distribution when parameters are given.

15. Fitting of normal distribution when parameters are not given

STAT CC- 4- Algebra

Marks : 100 (Theory : 70Tutorial/Internal : 30)   **Credit 6**

UNIT I

Theory of equations, statement of the fundamental theorem of algebra and its consequences. Relation between roots and coefficients or any polynomial equations. Solutions of cubic and biquadratic equations when some conditions on roots of equations are given. Evaluation of the symmetric polynomials and roots of cubic and biquadratic equations. Vector spaces, Subspaces, Span of a set, Linear dependence and independence, dimension and basis, dimension theorem (without proof).

UNIT II

Algebra of matrices - Types of Matrices: triangular, symmetric and skew symmetric matrices, idempotent matrices, Hermitian and skew Hermitian matrices, orthogonal matrices, singular and non-singular matrices related results and their properties. Trace of a matrix, unitary, involutory and nilpotent matrices.

UNIT III

Determinants of Matrices: Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants, Circulant determinants and Vandermonde determinants for nth order, Jacobi's Theorem, product of determinants. Adjoint and inverse of a matrix and related properties. Use of determinants in solution to the system of linear equations, row reduction and echelon forms, the matrix equations AX=B, solution sets of linear equations, linear independence, Applications of linear equations, inverse of a matrix.

UNIT IV

Rank of a matrix, row-rank, column-rank, standard theorems on ranks, rank of the sum and the product of two matrices. Generalized inverse (concept with illustrations).Partitioning of matrices and simple properties. Characteristic roots and Characteristic vector, useful Properties of characteristic roots, Cayley Hamilton theorem, Quadratic forms definition and classifications; Linear orthogonal transformation and their diagonalization.

SUGGESTED READINGS:
1. Lay David C.: Linear Algebra and its Applications, Addison Wesley, 2000.
2. Schaum's Outlines : Linear Algebra, Tata McGraw-Hill Edition, 3rdEdition, 2006.
3. Krishnamurthy V., Mainra V.P. and Arora J.L.: An Introduction to Linear Algebra (II, III, IV, V).
4. Jain P.K. and Khalil Ahmad: Metric Spaces, Narosa Publishing House, New Delhi, 1973
5. Biswas, S. (1997): A Textbook of Matrix Algebra, New Age International, 1997.
6. Gupta S.C.: An Introduction to Matrices (Reprint). Sultan Chand & Sons, 2008.
7. Datta K.B.: Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd., 2002.
PRACTICAL /LAB WORK: Tutorial/Internal

STAT-CC-5 - Sampling Distributions

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Limit laws: convergence in probability, almost sure convergence, convergence in mean square and convergence in distribution and their inter relations, Chebyshev's inequality, W.L.L.N., S.L.L.N. and their applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variates, applications of C.L.T. and Liapunov Theorem (without proof).
Order Statistics: Introduction, distribution of the rth order statistic, smallest and largest order statistics. Joint distribution of rth and sth order statistics, distribution of sample median and sample range.

UNIT II

Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Large sample tests, use of CLT for testing single proportion, difference of two proportions, single mean, difference of two means, standard deviation and difference of standard deviations by classical and p-value approaches.

UNIT III

Exact sampling distribution: Definition and derivation of p.d.f. of χ^2 with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of χ^2 distribution. Tests of significance and confidence intervals based on distribution.

UNIT IV*

Exact sampling distributions: Student's and Fishers t-distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution.
Snedecore's F-distribution: Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $1/F(n_1,n_2)$. Relationship between t, F and χ^2 distributions. Test of significance and confidence Intervals based on t and F distributions.
*only Central distributions

SUGGESTED READING:
1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): *An Outline of Statistical Theory*, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons. 14
3. Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education.
4. Johnson, R.A. and Bhattacharya, G.K. (2001): *Statistics-Principles and Methods*, 4th Edn. John Wiley and Sons.
5. 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.

STAT-CC-5 - Sampling Distributions

PRACTICAL /LAB WORK

List of Practical

1. Testing of significance and confidence intervals for single proportion and difference of two proportions

2. Testing of significance and confidence intervals for single mean and difference of two means and paired tests.

3. Testing of significance and confidence intervals for difference of two standard deviations.

4. Exact Sample Tests based on Chi-Square Distribution.

5. Testing if the population variance has a specific value and its confidence intervals.

6. Testing of goodness of fit.

7. Testing of independence of attributes.

8. Testing based on 2 X 2 contingency table without and with Yates' corrections.

9. Testing of significance and confidence intervals of an observed sample correlation coefficient.

10. Testing and confidence intervals of equality of two population variances

STAT-CC-6 - Survey Sampling and Indian Official Statistics

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Concept of population and sample, complete enumeration versus sampling, sampling and non-sampling errors. Types of sampling: non-probability and probability sampling, basic principle of sample survey, simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of: population mean, total and proportion, variances of these estimates, estimates of their variances and sample size determination.

UNIT II

Stratified random sampling: Technique, estimates of population mean and total, variances of these estimates, proportional and optimum allocations and their comparison with SRS. Practical difficulties in allocation, estimation of gain in precision. Systematic Sampling: Technique, estimates of population mean and total, variances of these estimates (N=nxk). Comparison of systematic sampling with SRS and stratified sampling in the presence of linear trend and corrections.

UNIT III

Introduction to Ratio and regression methods of estimation, first approximation to the population mean and total (for SRS of large size), variances of these estimates and estimates of these variances, variances in terms of correlation coefficient for regression method of estimation and their comparison with SRS. Cluster sampling (equal clusters only) estimation of population mean and its variance, comparison (with and without randomly formed clusters). Relative efficiency of cluster sampling with SRS in terms of intra class correlation. Concept of sub sampling

UNIT IV

Present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission. Government of India's Principal publications containing data on the topics such as population, industry and finance.

SUGGESTED READING:

1. Cochran W.G. (1984):Sampling Techniques(3rd Ed.), Wiley Eastern.
2. Sukhatme,P.V., Sukhatme,B.V. Sukhatme,S. Asok,C.(1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics
3. Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta.
4. Des Raj and Chandhok P. (1998): Sample Survey Theory, Narosa Publishing House.
5. Goon A.M., Gupta M.K. and Dasgupta B. (2001): Fundamentals of Statistics (Vol.2), World Press.
6. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.
7. http://mospi.nic.in/

STAT-CC-6 - Survey Sampling and Indian Official Statistics

PRACTICAL /LAB WORK

List of Practical

1. To select a SRS with and without replacement.

2. For a population of size 10, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 4 by WR and WOR and establish all properties relative to SRS.

3. For SRSWOR, estimate mean, standard error.

4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of above two methods relative to SRS

5. Estimation of gain in precision in stratified sampling.

6. Comparison of systematic sampling with stratified sampling and SRS in the presence of a linear trend.

7. Ratio and Regression estimation: Calculate the population mean or total of the population. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS.

8. Cluster sampling: estimation of mean or total, variance of the estimate, estimate of intra-class correlation coefficient, efficiency as compared to SRS .

STAT CC- 7 - Mathematical Analysis

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT-I

Real Analysis: Representation of real numbers as points on the line and the set of real numbers as complete ordered field. Bounded and unbounded sets, neighborhoods and limit points, Superimum and infimum, derived sets, open and closed sets, sequences and their convergence, limits of some special sequences such as and Cauchy's general principle of convergence, Cauchy's first theorem on limits, monotonic sequences, limit superior and limit inferior of a bounded sequence.

UNIT-II

Infinite series, positive termed series and their convergence, Comparison test, D'Alembert's ratio test, Cauchy's nth root test, Raabe's test. Gauss test, Cauchy's condensation test and integral test (Statements and Examples only). Absolute convergence of series, Leibnitz's test for the convergence of alternating series, Conditional convergence. Indeterminate form, L' Hospital's rule.

UNIT-III

Review of limit, continuity and differentiability, uniform Continuity and boundedness of a function. Rolle's and Lagrange's Mean Value theorems. Taylor's theorem with lagrange's and Cauchy's form of remainder (without proof). Taylor's and Maclaurin's series expansions of $\sin(x)$, $\cos(x)$, $\log(1+x)$.

UNIT-IV

Numerical Analysis: Factorial, finite differences and interpolation, Operators, E and divided difference. Newton's forward, backward and divided differences interpolation formulae. Lagrange's interpolation formulae, Numerical integration, Trapezoidal rule, Simpson's one-third rule, three-eight rule, Weddle's rule with error terms, Difference equations of first order and their solutions, Solution of Transcendental equations with NR method.

SUGGESTED READINGS:
1. Malik S.C. and Savita Arora: Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi, 1994.
2. Appostol T.M.: Mathematical Analysis, Second Edition, Narosa Publishing House, NewDelhi, 1987.
3. Shanti Narayan: A course of Mathematical Analysis, 12th revised Edition, S. Chand & Co. (Pvt.) Ltd., New Delhi, 1987.
4. Bartle, R. G. and Sherbert, D. R. (2002): Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore.
5. Ghorpade, Sudhir R. and Limaye, Balmohan V. (2006): A Course in Calculus and Real Analysis,Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint.
6. Jain,M. K., Iyengar, S. R. K. and Jain, R. K. (2003): Numerical methods for scientific and engineering computation, New age International Publisher, India.
PRACTICAL /LAB WORK: Tutorial/Internal

STAT-CC-8- Statistical Inference

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality and MVB estimators (statement and applications).

UNIT II

Methods of Estimation: Method of moments, method of maximum likelihood estimation, method of minimum Chi-square, basic idea of Bayes estimators.

UNIT III

Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof).

UNIT IV

Sequential Analysis: Sequential probability ratio test (SPRT) for simple vs simple hypotheses. Fundamental relations among α, β, A and B, determination of A and B in practice. Wald's fundamental identity (sans proof) and the derivation of operating characteristics (OC) and average sample number (ASN) functions, examples based on normal, Poisson, binomial and exponential distributions.

SUGGESTED READINGS:

1. Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.
3. Miller, I. and Miller, M. (2002) : John E. Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India.
4. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
5. Mood A.M, Graybill F.A. and Boes D.C,: Introduction to the Theory of Statistics, McGraw Hill.
6. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
7. Snedecor G.W and Cochran W.G.(1967) Statistical Methods. Iowa State University Press. 20

STAT-CC-8- Statistical Inference

PRACTICAL /LAB WORK

List of Practical

1. Unbiased estimators (including unbiased but absurd estimators)

2. Consistent estimators, efficient estimators and relative efficiency of estimators.

3. Cramer-Rao inequality and MVB estimators

4. Sufficient Estimators – Factorization Theorem, Rao-Blackwell theorem, Complete Sufficient estimators

5. Lehman-Scheffe theorem and UMVUE

6. Maximum Likelihood Estimation

7. Asymptotic distribution of maximum likelihood estimators

8. Estimation by the method of moments, minimum Chi-square

9. Type I and Type II errors

10. Most powerful critical region (NP Lemma)

11. Uniformly most powerful critical region

12. Unbiased critical region

13. Power curves

14. Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis

15. Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis

16. Asymptotic properties of LR tests

17. SPRT procedure

18. OC function and OC curve

19. ASN function and ASN curve.

STAT-CC-9- Linear Models

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Gauss-Markov set-up: Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation of error variance.

UNIT II

Regression analysis: Simple regression analysis, Estimation and hypothesis testing in case of simple and multiple regression models (Matrix and scalar versions) and estimation.

UNIT III

Analysis of variance: Definitions of fixed, random and mixed effect models, analysis of variance and covariance in one-way classified data for fixed effect models, analysis of variance and covariance in two-way classified data with one observation per cell for fixed effect models .

UNIT IV

Model checking: Prediction from a fitted model, Violation of usual assumptions concerning normality, Homoscedasticity and collinearity, Diagnostics using quantile-quantile plots.

SUGGESTED READINGS:

1. Weisberg, S. (2005). Applied Linear Regression (Third edition). Wiley.
2. Wu, C. F. J. And Hamada, M. (2009). Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.
3. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.

STAT-CC-9- Linear Models

PRACTICAL /LAB WORK

List of Practical

1. Estimability when X is a full rank matrix and not a full rank matrix

2. Distribution of Quadratic forms

3. Simple Linear Regression

4. Multiple Regression

5. Tests for Linear Hypothesis

6. Bias in regression estimates

7. Lack of fit

8. Orthogonal Polynomials

9. Analysis of Variance of a one way classified data

10. Analysis of Variance of a two way classified data with one observation per cell

11. Analysis of Covariance of a one way classified data

12. Analysis of Covariance of a two way classified data

STAT-CC-10- Statistical Quality Control

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

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. Statistical Control Charts- Construction and Statistical basis of 3-σ Control charts, Rational Sub-grouping.

UNIT II

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. Analysis of patterns on control chart, estimation of process capability.

UNIT III

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

UNIT IV

Introduction to Six-Sigma: Overview of Six Sigma, Lean Manufacturing and Total Quality Management (TQM). Organizational Structure and Six Sigma training plans- Selection Criteria for Six-Sigma roles and training plans. Voice of customers (VOC): Importance and VOC data collection. Critical to Quality (CTQ).Introduction to DMAIC using one case study: Define Phase, Measure Phase, Analyse Phase, Improve Phase and Control Phase.

SUGGESTED READING:

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.
5. Ehrlich, B. Harris (2002): Transactional Six Sigma and Lean Servicing, 2nd Edition, St. Lucie Press.
6. Hoyle, David (1995): ISO Quality Systems Handbook, 2nd Edition, Butterworth Heinemann Publication. 23

STAT-CC-10- Statistical Quality Control

PRACTICAL /LAB WORK

List of Practical

1. Construction and interpretation of statistical control charts

 X-bar & R-chart

 X-bar & s-chart

 np-chart

 p-chart

 c-chart

 u-chart

2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves

3. Calculation of process capability and comparison of 3-sigma control limits with specification limits.

4. Use a case study to apply the concept of six sigma application in DMAIC: practical application.

STAT-CC-11- Stochastic Processes and Queuing Theory

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Probability Distributions: Generating functions, Bivariate probability generating function. Stochastic Process: Introduction, Stationary Process.

UNIT II

Markov Chains: Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Generalization of independent Bernoulli trials, classification of states and chains, stability of Markov system, graph theoretic approach.

UNIT III

Poisson Process: postulates of Poisson process, properties of Poisson process, inter-arrival time, pure birth process, Yule Furry process, birth and death process, pure death process.

UNIT IV

Queuing System: General concept, steady state distribution, queuing model, M/M/1 with finite and infinite system capacity, waiting time distribution in stationary cases only (without proof).

SUGGESTED READING:

1. Medhi, J. (2009): Stochastic Processes, New Age International Publishers.
2. Basu, A.K. (2005): Introduction to Stochastic Processes, Narosa Publishing.
3. Bhat,B.R.(2000): Stochastic Models: Analysis and Applications, New Age International Publishers.
4. Taha, H. (1995): Operations Research: An Introduction, Prentice- Hall India.
5. Feller, William (1968): Introduction to probability Theory and Its Applications, Vol I, 3rd Edition, Wiley International.

STAT-CC-11- Stochastic Processes and Queuing Theory

PRACTICAL /LAB WORK

List of Practical

1. Calculation of transition probability matrix

2. Identification of characteristics of reducible and irreducible chains.

3. Identification of types of classes

4. Identification of ergodic transition probability matrix

5. Stationarity of Markov chain and graphical representation of Markov chain

6. Computation of probabilities in case of generalizations of independent Bernoulli trials

7. Calculation of probabilities for given birth and death rates and vice versa

8. Calculation of probabilities for Birth and Death Process

9. Calculation of probabilities for Yule Furry Process

10. Computation of inter-arrival time for a Poisson process.

11. Calculation of Probability and parameters for (M/M/1) model and change in behaviour of queue as N tends to infinity.

12. Calculation of generating function and expected duration for different amounts of stake.

13. Computation of probabilities and expected duration between players

STAT-CC-12 - Statistical Computing Using C/C++ /Python Programming

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

History and importance of C/C++ /Python. Components, basic structure programming, character set, C tokens, Keywords and Identifiers and execution of a C/C++ /Python program. Data types: Basic data types, Enumerated data types, derived data types. Constants and variables: declaration and assignment of variables, Symbolic Constants, overflow and underflow of data.
Operators and Expressions: Arithmetic, relational, logical, assignment, increment/decrement, operators, precedence of operators in arithmetic, relational and logical expression. Implicit and explicit type conversions in expressions, library functions. Managing input and output operations: reading and printing formatted and unformatted data.

UNIT II

Decision making and branching - if…else, nesting of if…else, else if ladder, switch, conditional operator. Looping in C/C++ /Python for, nested for, while, do…while, jumps in and out of loops.
Arrays: Declaration and initialization of one-dim and two-dim arrays. Character arrays and strings: Declaring and initializing string variables, reading and writing strings from Terminal (using scanf and printf only).

UNIT III

User- defined functions: A multi-function program using user-defined functions, definition of functions, return values and their types, function prototypes and calls. Category of Functions: no arguments and no return values, arguments but no return values , arguments with return values, no arguments but returns a value, functions that return multiple values, Recursion function, Passing arrays to functions, Storage class of Variables.

UNIT IV

Pointers: Declaration and initialization of pointer variables, accessing the address of a variable, accessing a variable through its pointer, pointer expressions, pointer increments/decrement and scale factor. Pointers and arrays, arrays of pointers, pointers as function arguments, functions returning pointers.

SUGGESTED READING:

1. Kernighan, B.W. and Ritchie, D. (1988): C Programming Language, 2ndEdition,Prentice Hall.
2. Balagurusamy, E. (2011): Programming in ANSI C, 6th Edition, Tata McGraw Hill.
3. Gottfried, B.S. (1998): Schaum's Outlines: Programming with C, 2nd Edition, Tata McGraw Hill
4. Kamthane, A.N (2018):Programming and problem Solving with PHTHON, Tata McGraw Hill

STAT-CC-12 - Statistical Computing Using C Programming

PRACTICAL /LAB WORK

(Using C/C++/Python Programming Language)

List of Practical

1. Plot of a graph y = f(x)

2. Roots of a quadratic equation (with imaginary roots also)

3. Sorting of an array and hence finding median

4. Mean, Median and Mode of a Grouped Frequency Data

5. Variance and coefficient of variation of a Grouped Frequency Data

6. Preparing a frequency table

7. Value of n! using recursion

8. Random number generation from uniform, exponential, normal (using CLT) and gamma

distribution, calculate sample mean and variance and compare with population parameters.

9. Matrix addition, subtraction, multiplication Transpose and Trace

10. Fitting of Binomial, Poisson distribution and apply Chi-square test for goodness of fit

11. Chi-square contingency table

12. t-test for difference of means

13. Paired t-test

14. F-ratio test

15. Multiple and Partial correlation.

16. Compute ranks and then calculate rank correlation (without tied ranks)

17. Fitting of lines of regression

STAT-CC-13 - Design of Experiments

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Experimental designs: Role, historical perspective, terminology, experimental error, basic principles, uniformity trials, fertility contour maps, choice of size and shape of plots and blocks.
Basic designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, analysis with single missing observation.

UNIT II

Incomplete Block Designs: Balanced Incomplete Block Design (BIBD) – parameters, relationships among its parameters, incidence matrix and its properties.

UNIT III
Factorial experiments: advantages, notations and concepts, 2^2, $2^3 \ldots 2^n$ and 3^2 factorial experiments, design and analysis, Total and Partial confounding for 2^n ($n \leq 5$) and 3^2.

UNIT IV

Factorial experiments in a single replicate. Fractional factorial experiments: Construction of one-half and one-quarter fractions of 2^n ($n \leq 5$) factorial experiments.

SUGGESTED READINGS:

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley EasternLtd.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8thEdn. World Press, Kolkata.
4. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
5. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

STAT-CC-13 - Design of Experiments

PRACTICAL /LAB WORK

List of Practical

1. Analysis of a CRD

2. Analysis of an RBD

3. Analysis of an LSD

4. Analysis of an RBD with one missing observation

5. Analysis of an LSD with one missing observation

6. Intra Block analysis of a BIBD

7. Analysis of 2^2 and 2^3 factorial in CRD and RBD

8. Analysis of 2^2 and 2^3 factorial in LSD

9. Analysis of a completely confounded two level factorial design in 2 blocks

10. Analysis of a completely confounded two level factorial design in 4 blocks

11. Analysis of a partially confounded two level factorial design

12. Analysis of a single replicate of a 2^n design

13. Analysis of a fraction of 2^n factorial design

STAT-CC-14 - Multivariate Analysis and Nonparametric Methods

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Bivariate Normal Distribution (BVN): p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN.
Multivariate Data: Random Vector: Probability mass/density functions, Distribution function, Mean vector & Dispersion matrix, Marginal & Conditional distributions.

UNIT II

Multivariate Normal distribution and its properties. Sampling distribution for mean vector and variance-covariance matrix (sans deduction). Multiple and partial correlation coefficient and their properties.

UNIT III

Nonparametric Tests: Introduction and Concept, Test for randomness based on total number of runs, Empirical distribution function.

UNIT IV

Kolmogrov Smirnov test for one sample, Sign tests- one sample and two samples, Wilcoxon-Mann-Whitney test, Kruskal-Wallis test.

SUGGESTED READING:

1. Anderson, T.W. (2003): An Introduction to Multivariate Statistical Analysis, 3rdEdn., John Wiley
2. Muirhead, R.J. (1982): Aspects of Multivariate Statistical Theory, John Wiley.
3. Kshirsagar, A.M. (1972) :Multivariate Analysis, 1stEdn. Marcel Dekker.
4. Johnson, R.A. and Wichern, D.W. (2007): Applied Multivariate Analysis, 6thEdn., Pearson & Prentice Hall
5. Mukhopadhyay, P. :Mathematical Statistics.
6. Gibbons, J. D. and Chakraborty, S (2003): Nonparametric Statistical Inference. 4th Edition. Marcel Dekker, CRC.

STAT-CC-14 - Multivariate Analysis and Nonparametric Methods

PRACTICAL /LAB WORK

List of Practical

1. Multiple Correlation
2. Partial Correlation
3. Bivariate Normal Distribution,
4. Multivariate Normal Distribution
5. Test for randomness based on total number of runs,
6. Kolmogrov Smirnov test for one sample.
7. Sign test: one sample, two samples, and large samples.
8. Wilcoxon-Mann-Whitney U-test
9. Kruskal-Wallis test

STAT-DSE-1 Operations Research

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Introduction to Operations Research, phases of O.R., model building, various types of O.R. problems. Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. Simplex method for solving L.P.P. Charne's M-technique for solving L.P.P. involving artificial variables. Special cases of L.P.P. Concept of Duality in L.P.P.

UNIT II

Transportation Problem: Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution, special cases of transportation problem. Assignment problem: Hungarian method to find optimal assignment, special cases of assignment problem.

UNIT III

Game theory: Rectangular game, minimax-maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrix and solution of 2 X 2, rectangular game with mixed strategy.

UNIT IV

Inventory Management: ABC inventory system, characteristics of inventory system. EOQ Model and its variations, with and without shortages.

SUGGESTED READING:

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.
2. KantiSwarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
3. Hadley, G: (2002) : Linear Programming, Narosa Publications
4. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research- Concepts and cases, 9th Edition, Tata McGraw Hill

STAT-DSE-1 Operations Research

PRACTICAL /LAB WORK

List of Practical

1. Mathematical formulation of L.P.P and solving the problem using graphical method, Simplex technique and Charne's Big M method involving artificial variables.

2. Identifying Special cases by Graphical and Simplex method and interpretation

       a. Degenerate solution

       b. Unbounded solution

       c. Alternate solution

       d. Infeasible solution

3. Allocation problem using Transportation model

4. Allocation problem using Assignment model

5. Problems based on game matrix

6. To find optimal inventory policy for EOQ modelsand its variations

STAT-DSE-1 Econometrics

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Introduction: Econometric models and its essences. General linear model (GLM) and its estimation. Simultaneous equation model: structural and reduced forms.

UNIT II

Multicollinearity: Introduction and concepts, detection of multicollinearity, consequences, detection and remedies of multicollinearity, specification errors.

UNIT III

Generalized least squares estimation, Aitken estimators. Autocorrelation: concept, consequences of autocorrelated disturbances, detection and remedies of autocorrelation.

UNIT IV

Heteroscedastic disturbances: Concepts and efficiency of Aitken estimator with OLS estimator under heteroscedasticity. Consequences of heteroscedasticity. Tests and solutions of heteroscedasticity. Autoregressive and Lag models.

SUGGESTED READING:

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,
4. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

STAT-DSE-1 Econometrics

PRACTICAL /LAB WORK

List of Practical

1. Problems based on estimation of General linear model

2. Testing of parameters of General linear model

3. Forecasting of General linear model

4. Problems concerning specification errors

5. Problems related to consequences of Multicollinearity

6. Diagnostics of Multicollinearity

7. Problems related to consequences of Autocorrelation (AR(I))

8. Diagnostics of Autocorrelation

9. Estimation of problems of General linear model under Autocorrelation

10. Problems related to consequences Heteroscedasticity

11. Diagnostics of Heteroscedasticity

12. Estimation of problems of General linear model under Heteroscedastic distance terms

13. Problems related to General linear model under (Aitken Estimation)

14. Problems on Autoregressive and Lag models.

STAT-DSE-2 Time Series Analysis

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Introduction to time 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.

UNIT II

Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend.

UNIT III

Seasonal Component cont: Ratio to Moving Averages and Link Relative method, Deseasonalization. Cyclic Component: Harmonic Analysis. Some Special Processes: Moving-average (MA) process and Autoregressive (AR) process of orders one and two.

UNIT IV

Random Component: Variate component method. Forecasting: Exponential smoothing methods of forecasting; Box-Jenkins method; Stationary Time series: Weak stationarity, autocorrelation function and correlogram.

SUGGESTED READING:

1. Kendall M.G. (1976): Time Series, Charles Griffin.
2. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
3. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

PRACTICAL /LAB WORK:

List of Practical
1. Fitting and plotting of modified exponential curve
2. Fitting and plotting of Gompertz curve
3. Fitting and plotting of logistic curve
4. Fitting of trend by Moving Average Method
5. Measurement of Seasonal indices Ratio-to-Trend method
6. Measurement of Seasonal indices Ratio-to-Moving Average method
7. Measurement of seasonal indices Link Relative method
8. Calculation of variance of random component by variate difference method
9. Forecasting by exponential smoothing

STAT-DSE-2 Financial Statistics

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Probability review: Real valued random variables, expectation and variance, skewness and kurtosis, conditional probabilities and expectations. Discrete Stochastic Processes, Binomial processes, General random walks, Geometric random walks, Binomial models with state dependent increments.

UNIT II

Tools Needed For Option Pricing: Wiener process, stochastic integration, and stochastic differential equations. Introduction to derivatives: Forward contracts, spot price, forward price, future price. Call and put options, zero-coupon bonds and discount bonds

UNIT III

Pricing Derivatives: Arbitrage relations and perfect financial markets, pricing futures, put-call parity for European options, relationship between strike price and option price. Stochastic Models in Finance: Discrete time process- binomial model with period one.

UNIT IV

Stochastic Models in Finance: Continuous time process- geometric Brownian motion. Ito's lemma, Black-Scholes differential equation, Black-Scholes formula for European options, Hedging portfolios: Delta, Gamma and Theta hedging. Binomial Model for European options: Cox-Ross-Rubinstein approach to option pricing. Discrete dividends

SUGGESTED READING:

1. Franke, J., Hardle, W.K. And Hafner, C.M. (2011): Statistics of Financial Markets: AnIntroduction, 3rdEdition, Springer Publications.
2. Stanley L. S. (2012): A Course on Statistics for Finance, Chapman and Hall/CRC.

STAT-DSE-2 Financial Statistics

PRACTICAL /LAB WORK

List of Practical

1. To verify "no arbitrage" principle

2. To verify relationship between spot price, forward price, future price

3. To price future contracts

4. To verify put-call parity for European options

5. To construct binomial trees and to evaluate options using these trees

6. To price options using black – Scholes formula

7. To hedge portfolios using delta and gamma hedging

8. To hedge portfolios theta hedging

9. Pricing of call options using binomial model

10. Computation of dividends on call options as a percentage of stock price.

11. Computation of dividends on call options as a fixed amount of money.

12. Pricing of put options using binomial model

13. Call-put parity for options following binomial models.

14. Effect of dividends on put options.

STAT-DSE-3 Demography and Vital Statistics

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Nature and scope of Demography. Population theories – Malthus, Natural and Biological, Demographic transition. Demographic data- sources, coverage and content errors. Use of balancing equations and Chandrasekharan-Deming formula to check completeness of registration data. Adjustment of age data- Myer and UN indices. Population composition, dependency ratio.

UNIT II

Sources of collecting data on Vital statistics, errors in census and registration data. Measurement of population: rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rates (SDR), Infant Mortality Rate (IMR) and Standardized Death Rates.

UNIT III

Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life (Mortality) Tables: Assumption, description, construction of Life Tables and Uses of Life Tables. Abridged Life Tables; Concept and construction of abridged life tables by Reed-Merrell method, Greville's method and King's Method.

UNIT IV

Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

SUGGESTED READING:

1. Mukhopadhyay P. (1999): Applied Statistics, Books and Allied (P) Ltd.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
3. Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
4. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
5. Keyfitz N., Beckman John A.: Demogrphy through Problems S-Verlag New york.

STAT-DSE-3 Demography and Vital Statistics

PRACTICAL /LAB WORK

List of Practical

1. To calculate CDR and Age Specific death rate for a given set of data

2. To find Standardized death rate by:-

 (i) Direct method

(ii) Indirect method

3. To construct a complete life table

4. To fill in the missing entries in a life table

5. To calculate probabilities of death at pivotal ages and use it construct abridged life table using

    (i) Reed-Merrell Method,

    (ii) Greville's Method and

    (iii) King's Method

6. To calculate CBR, GFR, SFR, TFR for a given set of data

7. To calculate Crude rate of Natural Increase and Pearle's Vital Index for a given set of data

8. Calculate GRR and NRR for a given set of data and compare them

STAT-DSE-3 Actuarial Statistics

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

UNIT I

Introductory Statistics and Insurance Applications: Discrete, continuous and mixed probability distributions. Insurance applications, sum of random variables. Utility theory: Utility functions, expected utility criterion, types of utility function, insurance and utility theory.

UNIT II

Principles of Premium Calculation: Properties of premium principles, examples of premium principles. Individual risk models: models for individual claims, the sum of independent claims, approximations and their applications.

UNIT III

Survival Distribution and Life Tables: Uncertainty of age at death, survival function, timeuntil-death for a person, curate future lifetime, force of mortality, life tables with examples, deterministic survivorship group, life table characteristics, assumptions for fractional age, some analytical laws of mortality.

UNIT IV

Life Insurance: Models for insurance payable at the moment of death, insurance payable at the end of the year of death and their relationships. Life annuities: continuous life annuities, discrete life annuities, life annuities with periodic payments. Premiums: continuous and discrete premiums.

SUGGESTED READING:

1. Dickson, C. M. D. (2005): Insurance Risk And Ruin (International Series On Actuarial Science), Cambridge University Press.
2. Bowers, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A. And Nesbitt, C. J. (1997): Actuarial Mathematics, Society Of Actuaries, Itasca, Illinois, U.S.A.

STAT-DSE-3 Actuarial Statistics

PRACTICAL /LAB WORK

List of Practical

1. Risk computation for different utility models

2. Discrete and continuous risk calculations

3. Calculation of aggregate claims for collective risks

4. Calculation of aggregate claim for individual risks

5. Computing Ruin probabilities and aggregate losses

6. Annuity and present value of contract

7. Computing premium for different insurance schemes

8. Practical based on life models and tables

STAT-DSE-4 Project Work

Credit 6

Objective: The aim of the course is to initiate students to write and present a statistical report, under the supervision of a faculty, on some area of human interest. The project work will provide hands on training to the students to deal with data emanating from some real life situation and propel them to dwell on some theory or relate it to some theoretical concepts.

STAT-SEC-1- Statistical-Data Analysis Using Software Packages

Credit 2

This course will review and expand upon core topics in statistics and probability, particularly by initiating the beneficiaries of the course to at least one of the software packages viz., SPSS, Minitab, Matlab/Scilab, for statistical computing.

UNIT I
Data loading, plot viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data.

UNIT II
Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.

UNIT III
Random number generation and sampling procedures, Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

UNIT IV
Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

SUGGESTED READING:
1. Moore, D.S. and McCabe, G.P. and Craig, B.A. (2014): Introduction to the Practice of Statistics, W.H. Freeman
2. Cunningham, B.J (2012):Using SPSS: An Interactive Hands-on approach
3. Cho, M,J., Martinez, W.L. (2014) Statistics in MATLAB: A Primer, Chapman and Hall/CRC 59

STAT-SEC-2- Statistical Data Analysis Using R

Credit 2

This course will review and expand upon core topics in probability and statistics through the study and practice of data analysis and graphical interpretation using `R'.

UNIT I

Data Loading, bar charts, pie charts, histograms (equal class intervals and unequal class intervals), frequency polygon, ogives, box plot, stem-leaf.

UNIT II

Generate automated reports giving detailed descriptive statistics, lines of regression and correlation.

UNIT III

Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

UNIT IV

Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

SUGGESTED READING:
1. Gardener, M (2012) Beginning R: The Statistical Programming Language, Wiley Publications.
2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York 60

STAT-SEC-3 Statistical Techniques for Research Methods

Credit 2

Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies. The course aims at enabling students understand basic concepts and aspects related to research, data collection, analyses and interpretation.

UNIT I
Introduction: Meaning, objection and motivation in research, types of research, research approach, significance of research. Research problems: definition, selection and necessity of research problems.

UNIT II
Survey Methodology and Data Collection, inference and error in surveys, the target populations, sampling frames and coverage error, methods of data collection, non-response, questions and answers in surveys.

UNIT III
Processing, Data Analysis and Interpretation: Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation.

UNIT IV
Develop a questionnaire, collect survey data pertaining to a research problem (such as gender discriminations in private v/s government sector, unemployment rates, removal of subsidy, impact on service class v/s unorganized sectors), interpret the results and draw inferences.

SUGGESTED READING:
1. Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised Edition reprint, New Age International Publishers.
2. Kumar, R (2011): Research Methodology: A Step - by - Step Guide for Beginners, SAGE publications.

STAT-SEC-4 Data Base Management Systems

Credit 2

UNIT I

Introduction: Overview of Database Management System, Introduction to Database Languages, advantages of DBMS over file processing systems.

UNIT II

Relational Database Management System: The Relational Model, Introduction to SQL: Basic Data Types, Working with relations of RDBMS: Creating relations e.g. Bank, College Database (create table statement)

UNIT III

Modifying relations (alter table statement), Integrity constraints over the relation like Primary Key , Foreign key, NOT NULL to the tables, advantages and disadvantages of relational Database System

UNIT IV

Database Structure: Introduction, Levels of abstraction in DBMS, View of data, Role of Database users and administrators, Database Structure: DDL, DML, Data Manager (Database Control System).Types of Data Models Hierarchical databases, Network databases, Relational databases, Object oriented databases.

SUGGESTED READING:

1. Gruber, M(1990): Understanding SQL, BPB publication
2. Silberschatz, A, Korth, H and Sudarshan,S(2011) "Database System and Concepts", 6th Edition McGraw-Hill.
3. Desai, B. (1991): Introduction to Database Management system, Galgotia Publications.

Choice Based Credit System (CBCS)

KOLHAN UNIVERSITY CHAIBASA

DEPARTMENT OF STATISTICS

U.G. SYLLABUS

PROGRAMME COURSE

(Courses effective from Academic Year 2017-18)

Updated june-2020

U.G General Course of Statistics

(DSC/GE)

Core Course Structure

Semester	Paper Code	Paper Name
I	DSC/GE-1	Basic Statistics and Probability
II	DSC/GE-2	Statistical Methodology
III	DSC/GE-3	Theory of Statistical Inference
IV	DSC/GE-4	Survey Sampling and Design of Experiments

SEC (Skill Enhancement Course)

Only for General (Programme) Course

Semester	Paper Code	Paper Name
III	SEC-1	Data Analysis using Spread Sheet
IV	SEC-2	Statistical Computations using Software (SPSS/R)
V	SEC-3	Simulation Techniques in Statistics
VI	SEC-4	Statistical Techniques for Research Methods

Discipline Specific Elective

Only for General (Programme) Course

Semester	Paper Code	Paper Name
V	DSE-1	Demography/ Applied Statistics-I
VI	DSE-2	Demand Analysis and Linear Regression / Applied/Statistics- II

DSC/GE- 1: Basic Statistics and Probability

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

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.

UNIT III

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 IV

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.

SUGGESTED READING:

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.

DSC/GE- 2: Statistical Methodology

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

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.

UNIT II

Bivariate probability distributions, marginal and conditional distributions; independence of variates (only general idea to be given). Transformation in univariate and bivariate distributions.

UNIT III

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

UNIT IV

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

SUGGESTED READING:

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.

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.

DSC/GE- 3: Theory of Statistical Inference

Marks : 100 (Theory : 70 Practical : 30)   **Credit 6**

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).

UNIT IV

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.

SUGGESTED READING:

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.

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.

DSC/GE- 4: Survey Sampling and Design of Experiments

Marks : 100 (Theory : 70 Practical : 30)   Credit 6

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.

UNIT III

Missing plot technique: Analysis under a single missing observation: Missing plot technique for RBD and LSD. Factorial experiments: 2^2 and 2^3 Factorial experiments: construction and analysis.

UNIT IV

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.

SUGGESTED READING:

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/

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.

SEC-1: Data Analysis using spread sheet

Marks : 50 (Theory : 35 Practical : 15)   Credit 2

UNIT I

Graphical Representations-Role, historical perspective, terminology, types of class interval-inclusive, exclusive, Formula to generate class intervals, types of graphs-Histogram,frequency curve, frequency polygon, pie chart, Ogive-more than and less than, Box plot,stem-leaf.

UNIT II

Measures of Central tendency-Arithmetic Mean, Harmonic Mean, Geometric Mean,Median and Mode explanation with example, Measures of Dispersion-Range, Semi Interquartile Range, Standard Deviation, Mean Deviation and explanation with example.

UNIT III

Curve Fitting - Principle of least squares Method, fitting of various curves like Straight line, Second degree Polynomial, kth degree Polynomial and exponential curves,Plotting of various probability distribution like Binomial, Poisson, Normal Distribution with suitable example.

UNIT IV

Introduction to Correlation Analysis, role, uses, its properties and formula, Introduction to Regression Analysis, role, uses, properties of its coefficient and formula to calculate regression coefficient, Regression Line, explain with example.

SUGGESTED READING:

1. Artymiak, J. (2011). Beginning Open Office Calc: From Setting Up Simple Spreadsheets to Business Forecasting. Apress Publisher.
2. Billo, E. J. (2007). Excel for Scientists and Engineers Numerical Methods. John Wiley & Sons.
3. Carlberg, C. (2011). Statistical Analysis. Pearsons Education Inc.
4. Held, B. (2007). Microsoft Excel Functions and Formulas. Wordware Publishing, Inc.
5. Kanji, G.K. (2006). 100 Statistical Tests (3rd ed.). Sage Publication.
6. Remenyi, D., Onofrei, G. and English, J. (2011). An Introduction to Statistics using Microsoft Excel. Academic Publishing Limited.

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.

SEC-2: Statistical Computations using Software (SPSS/R)

Marks : 50 (Theory : 35 Practical : 15)   Credit 2

This course will review topics in probability and statistics studied in core for data analysis.

Introduction to SPSS for statistical computing, analysis and graphical interpretation would be done using software skills. The following problems can be done on any one of the statistical software to enhance data analysis skills using software.

  (i)   Fitting of Binomial, Poisson, Negative Binomial, Normal Distributions.

  (ii)   Applications of Chi-square, t and F Distributions.

  (iii)   Calculation of correlation coefficient, Rank Correlation, etc.

  (iv)   Fitting of polynomials and regression curves.

  (v)   Methods of estimation (MLE and method of Moments).

  (vi)   Selecting a simple random sample using random number tables.

SUGGESTED READING:

  1. Cunningham, B.J. (2012). Using SPSS: An Interactive Hands-on approach.

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.

SEC-3: Simulation Techniques in Statistics

Marks : 50 (Theory : 35 Practical : 15)   Credit 2

UNIT I

Introduction: Need for simulation, general principles, simulation models, event type simulation.

UNIT II

Random numbers generation: Pseudo random number generators, The inverse transform method, Discrete and Continuous distributions, Transformation of random variables.

UNIT III

Applications of simulation: Monte Carlo simulation technique. Inventory problems, Queueing systems.

UNIT IV

Advantages and disadvantages of simulation, simulation of languages, Scope of simulation technique.

SUGGESTED READING:

1. Swarup, K., Gupta, P.K. and Mohan, M. (2001). Operations Research (9th ed.). Sultan Chand & Sons.
2. Payer, T. A. (1982). Introduction to simulation. McGraw Hill.
3. Voss, J. (2014). An introduction to statistical computing: A simulation-based approach (1st ed.). Wiley series in computational statistics.

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.

SEC-4: Statistical Techniques for Research Methods

Marks : 50 (Theory : 35 Practical : 15)   Credit 2

UNIT I

Introduction: Meaning, objection and motivation in research, types of research, research approach, significance of research. Research problems: definition, selection and necessity of research problems.

UNIT II

Survey Methodology and Data Collection, inference and error in surveys, the target populations, sampling frames and coverage error, methods of data collection, non-response, questions and answers in surveys.

UNIT III

Processing, Data Analysis and Interpretation: Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation.

UNIT IV

Develop a questionnaire, collect survey data pertaining to a research problem (such as gender discriminations in private v/s government sector, unemployment rates, removal of subsidy, impact on service class v/s unorganized sectors), interpret the results and draw inferences.

SUGGESTED READING:

1. Cochran, W.G. and Cox, G.M. (1959). Experimental Design. Asia Publishing House.
2. Kothari, C.R. (2015). Research Methodology: Methods and Techniques (3rd ed. reprint). New Age International Publishers.
3. Kumar, R. (2011). Research Methodology: A Step - by - Step Guide for Beginners. SAGE publications.
4. Project Work (using spread sheet and statistical packages –SPSS/R)

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.

DSE 1-: Demography

Marks : 100 (Theory : 70 Practical : 30)   Credit 6

UNIT I

Population Theories: Coverage and content errors in demographic data, use of balancing equations and Chandrasekaran-Deming formula to check completeness of registration data. Adjustment of age data, use of Myer and UN indices, Population composition, dependency ratio.

UNIT II

Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.

UNIT III

Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life (Mortality) Tables: Assumption, description, construction of Life Tables and Uses of Life Tables.

UNIT IV

Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

SUGGESTED READING:

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.

PRACTICAL /LAB WORK:

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DSE 1-: Applied Statistics- I

Marks : 100 (Theory : 70 Practical : 30)   Credit 6

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.

UNIT III

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 IV

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.

SUGGESTED READING:

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.

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.

DSE 2-: Demand Analysis and Linear Regression

Marks : 100 (Theory : 70 Practical : 30)   Credit 6

UNIT I

Demand Analysis: Demand function, price and income elasticity of demand, nature of commodities, laws of supply and demand.

UNIT II

Income distributions, Pareto – curves of concentration. Utility and Production Functions: utility function, constrained utility maximization, indifference curves, derivation of demand curve, production function, homogeneous production functions, Elasticity of substitution for linear homogeneous functions.

UNIT III

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, lack of fit and pure Error, Best Linear Unbiased Estimator (BLUE), confidence intervals.

UNIT IV

Gauss-Markov theorem, Multiple Linear Regression: OLS Estimation of parameters; properties of OLS estimators, goodness of fit - R2 , partial regression coefficients and testing of hypotheses on parameters (individual and joint).

SUGGESTED READING:

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.

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.

DSE 2-: Applied Statistics- II

Marks : 100 (Theory : 70 Practical : 30)   Credit 6

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.

UNIT II

Statistical Process Control - Seven tools of SPC, chance and assignable causes of quality variation.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.

UNIT III

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 IV

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.

SUGGESTED READING:

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.

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.