

Choice Based Credit System (CBCS)

**KOLHAN UNIVERSITY,
CHAIBASA**

**B.SC.HONOURS
STATISTICS**

(Courses effective from Academic Year 2017-18)

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses

CORE COURSES STRUCTURE

(14 papers) (Credit: 6=4+2 each) (Theory+ Practical)

Semester I

C STAT 101 Descriptive Statistics

C STAT 102 Numerical Analysis

Semester II

C STAT 203 Probability and Probability Distributions

C STAT 204 Sampling Distributions and Testing of hypothesis

Semester III

C STAT 305 Demography and Vital Statistics

C STAT 306 Survey Sampling

C STAT 307 Operation Research

Semester IV

C STAT 408 Statistical Inferences

C STAT 409 Psychological and Educational Statistics

C STAT 410 Statistical Quality Control

Semester V

C STAT 511 Stochastic Processes and Queuing Theory

C STAT 512 Statistical Computing

Semester VI

C STAT 613 Design of Experiments

C STAT 614 Index number and Indian Official Statistics

DISCIPLINE SPECIFIC ELECTIVE COURSES STRUCTURE

(Credit: 6 each) (Theory+ Practical)

(4 papers to be selected)

Semester V

1. **DSE STAT 501A** Time Series Analysis **or** **DSE STAT 501 B** Financial Statistics

2. **DSE STAT 502A** Reliability **or** **DSE STAT 502 B** Econometrics

Semester VI

3. **DSE STAT 603A** Actuarial Statistics **or** **DSE STAT 603B** Survival Analysis and Biostatistics

4. **DSE STAT 604** Project Work (Sixth Semester)

Semester	Core Course (14 Papers)	Papers Code and Papers Name	Ability Enhancement Compulsory Course (AECC) (2 Papers)	Skill Enhancement Courses(SEC) (2Papers)	Elective Discipline Specific Elective (DSE) (4 Papers)	Elective Generic Elective (GE) (4 Papers)
I	C1	C STAT 101 Descriptive Statistics	AECC 1 English/MIL Communication			GE 1
	C2	C STAT 102 Numerical Analysis				
II	C3	C STAT 203 Probability and Probability Distributions	AECC 2 Environmental Science			GE 2
	C4	C STAT 204 Sampling Distributions and Testing of hypothesis				
III	C5	C STAT 305 Demography and Vital Statistics		SEC 1 Current Affairs		GE 3
	C6	C STAT 306 Survey Sampling				
	C7	C STAT 307 Operation Research				
IV	C8	C STAT 408 Statistical Inference		SEC 2 Personality Develop ment		GE 4
	C9	C STAT 409 Psychological and Educational Statistics				
	C10	C STAT 410 Statistical Quality Control				
V	C11	C STAT 511 Stochastic Processes and Queuing Theory			DSE STAT 501A Time Series Analysis Or DSE STAT 501 B Financial Statistics	
	C12	C STAT 512 Statistical Computing				
VI	C13	C STAT 613 Design of Experiments			DSE STAT 603A Actuarial Statistics Or DSE STAT 603B Survival Analysis and Biostatistics	
	C14	C STAT 614 Index number and Indian Official Statistics				
					DSE STAT 604 Project Work	

C STAT 101 Descriptive Statistics

UNIT I

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement-nominal, 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

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.

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.

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.

C STAT 102 Numerical Analysis

UNIT-I

Finite differences of different orders, Δ , E and D operators, separation of symbols, sub-division of intervals, Differences of a polynomial,

Concept of interpolation and extrapolation:

Newton Formulae for interpolation. central difference formula due to Gauss, Stirling, Bessel, Newton Gregory's forward and backward interpolation formulae for equal intervals, divided differences and their properties, Newton's formula for divided difference, Lagranges formula for unequal intervals, central difference formula due to Gauss, Stirling, Bessel,

UNIT-II

Inverse interpolation: Method of Successive Approximation, Solution of algebraic and transcendental equations, difference equation with constant coefficients, simple cases of numerical solutions of differential equation.

UNIT-III

Numerical Quadrature : trapezoidal rule, Simpson's one-third and three-eighth rules, Weddle's rule.

UNIT-IV

Summation of series: Summation of series through calculus of finite difference.

Numerical solutions of differential equations: Solution by Taylor's series, Picard's method of successive Approximation Euler's method, Modified Euler's 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. Somasundram D. and Chaudhary B.: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1987.
3. Scarborough J.B.: Numerical Mathematical Analysis, Oxford University, Press and Oxford Book Co.
4. Saxena, H.C.: Calculus of finite Differences,
5. Freeman. H.: Finite Differences for Actuarial Students, Cambridge University Press.
6. Aitkinson U.: Elementary Numerical Analysis.
7. Sastry S.S.: Introductory Methods of Numerical Analysis, Fourth Edition, Prentice Hall of India.
8. Kunz, K.S.: Numerical Analysis, McGraw Hill.

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.

C STAT 203 Probability and Probability Distributions

UNIT I

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 II

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 III

Discrete Probability Distributions: Uniform, Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric distributions along with their characteristic properties and limiting/approximation cases.

UNIT IV

Continuous probability distributions: Normal, Exponential, Uniform, Beta, Gamma, Cauchy along with their characteristic 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

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.

C STAT 204 Sampling Distributions and testing of hypothesis

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 χ^2 distribution.

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.

UNIT IV

Nonparametric Tests: Introduction and Concept, Test for randomness based on total number of runs, Empirical distribution function, Kolmogrov Smirnov test for one sample, Sign tests- one sample and two samples, Wilcoxon-Mann-Whitney test, Kruskal-Wallis test.

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*. 2nd Edn. (Reprint) 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.

C STAT 305 Demography and Vital Statistics

UNIT I

Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events

UNIT II

Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR).

UNIT III

Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.

Stationary and Stable population, Central Mortality Rates and Force of Mortality.

UNIT IV

Life(Mortality) Tables: Assumption, description, construction of Life Tables and Uses of Life Tables. Abridged Life Table;

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.

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.

C STAT 306 Survey Sampling

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, and its performance. Systematic Sampling: Technique, estimates of population mean and total, variances of these estimates ($N=nxk$). Comparison of systematic sampling with SRS and stratified sampling

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.

UNIT IV

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

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.

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.

C STAT 307 Operation Research

UNIT I

Definitions and scope of operation research, different types of models in operations research – their construction and general method of solution. Elements of linear programming problem (LPP): Canonical and standard forms, formulation of LPP, graphical method to solve two variable LPP, solution of LPP using simplex procedure, use of artificial variables in LPP, generation of extreme point solutions, principle of duality in LPP, statement and proof of duality theorem, simple problems based on duality theorem.

UNIT II

Allocation Models: Transportation problem (T.P.), different methods of finding initial feasible solution of a T.P., UV method of finding optimal solution of a T.P., solution of assignment problem using Hungarian method.

UNIT III

Inventory Control: Definitions of various costs involved in inventory control. Deterministic Economic Lot Size problems with and without shortages.

UNIT IV

Theory of games: Two person zero-sum games, pure and mixed strategies, saddle point, maximin-minimax principle of rectangular games, games without saddle point, dominance and modified dominance principles, graphical solution of $2 \times N$ and $M \times 2$ games, reduction of game problems to a L.P.P.

SUGGESTED READINGS:

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.
6. Kinti Swarup, Gupta and Mohan (1977), Operation Research, Sultan Chand 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.

C STAT 408 Statistical Inference

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 (Without Proof) 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

Interval estimation - Confidence interval for the parameters of various distributions, Confidence interval for Binomial proportion, Confidence interval for population correlation coefficient for Bivariate Normal distribution, Large sample confidence intervals.

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. 2nd Edn. (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.

PRACTICAL/LABWORK:

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

C STAT 409 Psychological and Educational Statistics

UNIT I

Introduction of Psychological and Educational Statistics, Scaling Individual Test item in terms of difficulty (σ -scaling), scaling of scores on a test , Different types of scores – Z score, Standard score, Normalized score and T score

UNIT II

Different methods of measuring reliability: Test –Retest Method, Alternate or Parallel forms method, split-half method, Rulon method of Estimating Reliability.

UNIT III

Method of Rational Equivalence or Kuder-Richardson Formula. Effect of test length on the reliability of the test. Effect of deferent ranges upon reliability of test,

UNIT IV

Validity of test scores. Calculation of validity .validity and test length. Lengthening needed to achieve validity, comparison between reliability and validity.

SUGGESTED READINGS:

1. Gupta S.C. and Kapoor V.K. (2014). Fundamentals of Applied Statistics. Sultan Chand and sons
2. Gulford and Fruchter (1974). Fundamentat Statistics in Psychology and Education. Mac Graw Hill
3. Zubiszyn and Borich (2003). Educational Testing and Measurement, 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.

C STAT 410 Statistical Quality Control

UNIT I

Quality: Definition Its concept, application and importance. Introduction to Process and Product Controls,. 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,

UNIT IV

Use and interpretation of Dodge and Romig's sampling inspection plan tables. Six Sigma and its concepts, DMAIC.

SUGGESTED READING:

1. Montgomery, 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 a.& II, 8th Edn. The World Press, Kolkata.
3. Montgomery, D. C. and Runger, G.C. (2008): Applied Statistics and Probability for Engineers, 3rd Edition reprint, Wiley India Pvt. Ltd.
4. Peter, S. Pande, Robert and Ronald (2002): The six Sigma way Team Fieldbook, TMH Publishing Company 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.

C STAT 511 Stochastic Processes and Queuing Theory

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 (without proof). Gambler's Ruin Problem: Classical ruin problem, expected duration of the game.

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.

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.

C STAT 512 Statistical Computing

UNIT I and UNIT II: C++

UNIT I

History and importance of C++. Components, basic structure programming, character set, C++ tokens, Keywords and Identifiers and execution of a C++ 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++: 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).

User- defined functions: A multi-function program using user-defined functions, definition of functions, return values and their types, function prototypes and calls.

UNIT III and UNIT IV: (at least one of the software packages viz., SPSS, Minitab, Matlab for statistical computing)

UNIT III

Data preparation and exploratory data analysis Getting familiar with the interface, Importing data from Excel, Data preparation and exploratory data analysis, Plotting several types of charts, Transforming variables

UNIT IV

Inferential Statistics for the mean and the median, Descriptive statistics for two or more variables, Creating and editing charts for two or more variables, Inferential statistics for the mean and the median, One-sample t-test, T-test and Mann-Whitney U Test, Paired-difference t-test & Wilcoxon Signed-Rank Test, Power Analysis for t-test, One-sample Chi-square, Chi-Squared Test of Independence, ANOVA and simple linear regression, One-way ANOVA & Kruskal-Wallis Test, Bivariate linear regression, Power Analysis for ANOVA and simple linear regression.

SUGGESTED READING:

1. Kernighan, B.W. and Ritchie, D. (1988): C Programming Language, 2nd Edition, Prentice Hall.
2. Ralaourisamy, F. (2011): Programming in ANSI C 3rd Edition, Tata McGraw Hill

3. Gottfried, B.S. (1998): Schaum's Outlines: Programming with C, 2nd Edition, Tata McGraw Hill
4. Zunningham, B.J (2012): Using SPSS: An Interactive Hands-on approach
5. Cho, M.J., Martinez, W.L. (2014) Statistics in MATLAB: A Primer, Chapman and Hall/CRC

PRACTICAL/ LAB WORK :

(Using C++ Programming Language and *at least one of the software packages viz., SPSS, Minitab, Matlab for statistical computing*)

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

C STAT 613 Design of Experiments

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, ANOVA (one way and two way classification).

UNIT II

Basic designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, analysis with missing observations.

UNIT III

Factorial experiments: advantages, notations and concepts, 2^2 , $2^3 \dots 2^n$ and 3^2 factorial experiments, design and analysis,

UNIT IV

Total and Partial confounding for 2^n ($n \leq 5$), 3^2 and 3^3 . Factorial experiments in a single replicate.

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 Eastern Ltd.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8th Edn. 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.

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.

C STAT 614 Index Number and Indian Official Statistics

UNIT I

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.

UNIT II

Consumer price index numbers. Compilation of indices, base shifting, splicing and deflating of index numbers. Index of industrial and agriculture production, usage and limitations of index numbers.

UNIT III

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.

UNIT IV

Government of India's Principal publications containing data on the topics such as population, industry and finance. Socio-economic indicators and Statistics of Jharkhand and India.

SUGGESTED READING:

1. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.
2. Gupta S.C., Kapoor V.K.(2007): Fundamentals of Applied Statistics. 4th Edition, Sultan Chand and Sons., New Delhi.

PRACTICALS/ 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.

Elective:DSE in Statistics

DSE STAT 501A Time Series Analysis

UNIT I

Introduction to times series data, application of time series from various fields, Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves.

UNIT II

Trend Cont.: 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)

UNIT IV

Random Component: Variate component method. Forecasting: Exponential smoothing methods, Short term forecasting methods: Brown's discounted regression, Box-Jenkins method and Bayesian forecasting. Stationary Time series: Weak stationary, autocorrelation function and correlogram of moving average.

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

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

DSE STAT 501 B Financial Statistics

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: An rd Introduction, 3 Edition, Springer Publications.
2. Stanley L. S. (2012): A Course on Statistics for Finance, Chapman and Hall/CRC.

PRACTICAL / LAB WORK (Using spreadsheet/ R)

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

DSE STAT 502A RELIABILITY

UNIT I

Life testing and reliability theory : Basic concepts of life testing experiments, reliability, hazard function and their relationship. Elementary notion of censored data, type I and type II censoring schemes, Poisson process.

UNIT I

Parametric distributions : Weibull, gamma, lognormal, exponential as life time distributions, point and interval estimation procedures for the above distributions.

UNIT III

Testing reliability hypothesis for exponential and Weibull distributions.
System reliability concepts : Parallel system, series system and k out of n system.

UNIT IV

Elementary idea of reliability models for non – maintained systems.

SUGGESTED READING:

1. Bain, L. J. and Engelhardt, M. : Statistical Analysis of Reliability and Life Testing Models, Marcel Dekker.
2. Zack, S. : Introduction to Reliability Analysis : Probability Model and Statistical Methods, Springer Verlag.
3. Barlow, R. E. and Proschan, F. : Statistical Theory of Reliability and Life Testing : Probability Models, Holit Rinechart and Winston.
4. Gnedenko, Bylyayer and Solovyer : Mathematical Methods of Reliability Theory.
5. Kale, B. K. and Sinha, S. K. : Life Testing and Reliability.

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 STAT 502B Econometrics

UNIT I

Introduction: Objective behind building econometric models, nature of econometrics, model building, role of econometrics, structural and reduced forms. General linear model (GLM). Estimation under linear restrictions.

UNIT II

Multicollinearity: Introduction and concepts, detection of multicollinearity, consequences, tests and solutions of multicollinearity, specification error.

UNIT III

Generalized least squares estimation, Aitken estimators. Autocorrelation: concept, consequences of autocorrelated disturbances, detection and solution 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, Dummy variables, Qualitative data.

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.

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 STAT 603A Actuarial Statistics

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, time-until-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.

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 STAT 603B Survival Analysis and Biostatistics

UNIT I

Survival Analysis: Functions of survival times, survival distributions and their applications-exponential, gamma, Weibull, Rayleigh, lognormal, death density function for a distribution having bath-tub shaped hazard function.

Censoring Schemes: Type I, Type II and progressive or random censoring with biological examples. Estimation of mean survival time and variance of the estimator for Type I and Type II censored data with numerical examples. Non-parametric methods: Actuarial and Kaplan-Meier methods for estimating survival function and variance of the Estimator.

UNIT II

Competing Risk Theory: Indices for measurement of probability of death under competing risks and their inter-relations. Estimation of probabilities of death using maximum likelihood principle and modified minimum Chi-square methods. Theory of independent and dependent risks. Bivariate normal dependent risk model.

UNIT III

Stochastic Epidemic Models: Simple epidemic models, general epidemic model definition and concept (without derivation). Duration of an epidemic.

UNIT IV

Statistical Genetics: Introduction, concepts-Genotype, Phenotype, Dominance, Recessiveness, Linkage and Recombination, Coupling and Repulsion. Mendelian laws of Heredity, Random mating, Gametic Array .relation between genotypic array and gametic array under random mating. Distribution of genotypes under random mating. Clinical Trials: Planning and design of clinical trials, Phase I, II and III trials. Single Blinding

SUGGESTED READING:

1. Lee, E.T. and Wang, J.W. (2003): Statistical Methods for Survival data Analysis, 3rd Edition, John Wiley and Sons.
2. Biswas, S. (2007): Applied Stochastic Processes: A Biostatistical and Population Oriented Approach, Reprinted 2nd Central Edition, New Central Book Agency.
3. Kleinbaum, D.G. (1996): Survival Analysis, Springer.
4. Chiang, C.L. (1968): Introduction to Stochastic Processes in Bio Statistics, John Wiley and Sons.
5. Indrayan, A. (2008): Medical Biostatistics, 2nd Edition Chapman and Hall/CRC.

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 STAT 604 Project Work

Optional Project work/Dissertation: It is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper in 6th Semester.

