SISTER NIVEDITA UNIVERSITY

SYLLABUS

FOR

THREE YEARS B.Sc (DEGREE) COURSE

IN

STATISTICS (HONOURS)

UNDER

UGC-CBCS SYSTEM

2021

B.Sc. Statistics(H) Course Structure

Category definition with credit breakup

Semester	Credit						
	CC	DSE	GE	AECC	SEC	USC	Total/Sem
First	12		4	2		2	20
Second	12	6	4	2	1	2	27
Third	12	6	4	2	1	2	27
Fourth	12	6	4	2	1	2	27
Fifth	18	6			1		25
Sixth	24						24
Total Credit/ Course	90	24	16	8	4	8	
Total Credit							150

CC: Core Courses; **GE**: General Elective; **AECC:** Ability Enhancement Compulsory Course; **SEC**: Skill Enhancement Courses; **DSE**: Discipline Specific Elective; **USC:** University specified course

First Year

Category	**Course Name**	**Credit**	**Teaching Scheme**		
			L	**T**	**P**
Semester – I					
CC – 1	Descriptive Statistics and Probability I	4	4	0	0
	Descriptive Statistics and Probability I Lab	2	0	0	4
CC – 2	Mathematics I	6	6	0	0
GE – 1	Generic Elective	4	4	0	0
AECC – 1	Communicative English – I	2	2	0	0
USC – 1	Foreign Language I	2	2	0	0
Total Credit = 20			Teaching Hour = 24		
Semester – II					
CC – 3	Probability II	4	4	0	0
	Probability II Lab	2	0	0	4
CC – 4	Sampling Distributions	4	4	0	0
	Sampling Distributions Lab	2	0	0	4
DSE – 1	Mathematics II	6	6	0	0
GE – 2	Generic Elective	4	4	0	0
AECC – 2	Communicative English – II	2	2	0	0
SEC – 1	Mentored Seminar – I	1	1	0	0
USC – 2	Foreign Language II	2	2	0	0
Total Credit = 27			Teaching Hour = 33		

Second Year

Category	Course Name	Credit	Teaching Scheme		
			L	T	P
Semester – III					
CC – 5	Population Statistics	4	4	0	0
	Population Statistics Lab	2	0	0	4
CC – 6	Statistical Inference I	4	4	0	0
	Statistical Inference I Lab	2	0	0	4
DSE – 2	Mathematical Analysis	6	6	0	0
GE – 3	Generic Elective	4	4	0	0
AECC – 3	Environmental Science – I	2	2	0	0
SEC – 2	Mentored Seminar – II	1	1	0	0
USC – 3	Foreign Language III	2	2	0	0
Total Credit = 27			Teaching Hour = 33		
Semester – IV					
CC – 7	Statistical Inference II	4	4	0	0
	Statistical Inference II Lab	2	0	0	4
CC – 8	Sample Survey & Indian Official Statistics	4	4	0	0
	Sample Survey & Indian Official Statistics Lab	2	0	0	4
DSE – 3	Genetics	6	6	0	0
GE – 4	Generic Elective	4	4	0	0
AECC – 3	Environmental Science – II	2	2	0	0
SEC – 3	Mentored Seminar – III	1	1	0	0
USC – 4	Foreign Language – IV	2	2	0	0
Total Credit = 27			Teaching Hour = 33		

Third Year

Category	Course Name	Credit	Teaching Scheme		
			L	T	P
Semester – V					
CC – 9	Statistical Quality Control	4	4	0	0
	Statistical Quality Control Lab	2	0	0	4
CC – 10	Linear Model and Regression	4	4	0	0
	Linear Model and Regression Lab	2	0	0	4
CC – 11	Economic Statistics	4	4	0	0
	Economic Statistics Lab	2	0	0	4
DSE – 4	Statistical Computing with C++	4	4	0	0
	Statistical Computing with C++	2	0	0	4
SEC – 4	Mentored Seminar – IV	1	1	0	0
Total Credit = 25			Teaching Hour = 33		
Semester – VI					
CC – 12	Design of Experiment	4	4	0	0
	Design of Experiment Lab	2	0	0	4
CC – 13	Numerical Computing	4	4	0	0
	Numerical Computing Lab	2	0	0	4
CC – 14	Statistical Computing with R language	4	4	0	0
	Statistical Computing with R language	2	0	0	4
CC – 15	Project	6	0	0	12
Total Credit = 24			Teaching Hour = 36		

First Year
Semester-I
Descriptive Statistics and Probability I (CC-1)

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 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.

Descriptive Statistics and Probability I Lab:

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. B. Sc. Honours (Statistics)
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.

Mathematics I (CC-2)

Credit 6

UNIT I : Matrix Algebra- Introduction & definition, properties of matrix, special type of matrices, arithmetic of matrices, symmetric & skew-symmetric matrices, orthogonal matrices, singular and non-singular matrices with their properties, Trace of a matrix, Eigen value and Eigen vector computation, Inverse of a matrix and related properties, numerical problems solving.

UNIT II : Differential Calculus: Review of limit, continuity and differentiability, L-Hospital rule, Leibnitz rule, successive differentiation, Rolle's theorem, Mean value theorem, Taylor series expansion, Function of several variables, Euler's theorem on homogeneous function, Partial differentiation, Jacobian, Maxima and Minimum of functions of one and two variables.

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

UNIT IV: 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.

SUGGESTED READING:

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. Searle S.R: Matrix Algebra Useful for Statistics. John Wiley &Sons., 1982.
4. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad (14th Edition -1997).
5. Gorakh Prasad: Integral Calculus, PothishalaPvt. Ltd., Allahabad (14th Edition -2000).
6. David C. Lay: Linear Algebra and Its Applications, 3rd Edn, Pearson Education, Asia

Semester-II

Probability II (CC-3)

Credit 6

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

UNIT IV: Limit laws: convergence in probability, convergence in mean square and convergence in distribution and their inter relations, Chebyshev's inequality, W.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).

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

Probability II Lab

List of Practical

1. Fitting of binomial distributions for n and p = q = ½.
2. Fitting of binomial distributions for given n and p. B. Sc. Honours (Statistics) 12
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.

Sampling Distributions (CC-4)

Credit 6

UNIT I: 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.

UNIT II: Sampling distribution: Definition and derivation of p.d.f. of $\chi 2$ 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 $\chi 2$ distribution.

UNIT III: 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. Snedecor'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(n1,n2). Relationship between t, F and $\chi 2$ distributions.

UNIT IV: 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.

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. B. Sc. Honours (Statistics) 15
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.

Sampling Distributions Lab

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 (2×2) 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.

Second Year
Semester-III
Population Statistics (CC-5)

Credit 6

UNIT I : Population Theories: Coverage and content errors in demographic data, use of balancing equations and Chandrasekharan-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: Abridged Life Tables; Concept and construction of abridged life tables by Reed-Merrell method, Greville's method and King's Method. 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.

Population Statistics Lab

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.

Statistical Inference I (CC-6)

Credit 6

UNIT I: Estimation: Concepts of estimation, requirement of good estimator, unbiasedness, sufficiency; Minimum variance consistency and efficiency. Minimum variance unbiased estimator (MVUE), Correlation between MVUE and other unbiased estimator, Definition of sufficiency statistics and their role in estimation.

UNIT II: Consistency of the following statistics – Sample proportion statistics, Sample $\beta 1$ and $\beta 2$, sample quantiles, Efficiency of sample median from a normal population.

UNIT III: Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality and MVB estimators (statement and applications).

UNIT IV: Methods of Estimation: Method of Moments, Method of Least Square and Method of maximum likelihood estimation, method of minimum Chi-square, Derivation of maximum likelihood estimation for the parameters of standard statistical distribution.

SUGGESTED READING:

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.
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. lowa State University Press.
8. Bhattacharjee, D. & Das, K. K.(2008) A Treatise on Statistical Inference and Distributions, Asian Books, New Delhi.

Statistical Inference I Lab

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.

Semester-IV

Statistical Inference II (CC-7)

UNIT I :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 and relevant problems, properties of likelihood ratio tests (without proof).

UNIT II : 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, Pivotal quantity method of constructing confidence interval,
UNIT III: 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.
UNIT IV : Large sample tests, Large sample confidence intervals. Variance stabilizing methods.

SUGGESTED READING:

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. lowa State University Press.
8. Bhattacharjee, D. & Das, K. K.(2008) A Treatise on Statistical Inference and Distributions, Asian Books, New Delhi.

Statistical Inference II Lab

List of Practical:

1. Type I and Type II errors
2. Most powerful critical region (NP Lemma)
3. Uniformly most powerful critical region
4. Unbiased critical region.
5. Power curves
6. Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis
7. Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis
8. Asymptotic properties of LR tests
9. Test for randomness based on total number of runs,
10. Kolmogrov Smirnov test for one sample.
11. Sign test: one sample, two samples, large samples.
12. Wilcoxon-Mann-Whitney U-test
13. Kruskal-Wallis test

Sample Survey And Indian Official Statistics (CC-8)

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, post stratification 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 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. B. Sc. Honours (Statistics) 17
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/

Sample Survey and Indian Official Statistics Lab

List of Practical:

1. To select a SRS with and without replacement.
2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by WR and WOR and establish all properties relative to SRS.
3. For SRSWOR, estimate mean, standard error, the sample size
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.

Third Year
Semester-V
Statistical Quality Control (CC-9)

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: Process capability study, Index of process capability: Cp, Cpk and Cpmk and their uses, Estimation of process capability indices, Introduction to 6-sigma.

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

Statistical Quality Control Lab

List of Practical :

1. Construction and interpretation of statistical control charts ƒ X-bar & R-chart ƒ X-bar & s-chart ƒ np-chart ƒ p-chart ƒ c-chart ƒ 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.

Linear Models and Regression (CC-10)

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, Concept of model matrix and its use in 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 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, Logistic regression.

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.

Linear Models and Regression Lab

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

Economic Statistics (CC-11)

Credit 6

UNIT I: Probability Distributions: Generating functions, Bivariate probability generating function. Stochastic Process: Introduction, Stationary Process. Markov Chains: Definition of Markov Chain, transition probability matrix.

UNIT II: 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.

UNIT III : 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 with examples. 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 with examples.

UNIT IV: Forecasting: Exponential smoothing methods, Box-Jenkins method, Stationary Time series: Weak stationarity, Auto-covariance and Auto-correlation Function (ACF). Moving-average (MA) process and Autoregressive (AR) process of orders one and two, Estimation of the parameters of AR (1) and AR (2); Overview of ARMA model: ARMA (1,1) with illustrations.

Economic Statistics Lab

Practical list:

1. Calculation of transition probability matrix
6. Calculate price and quantity index numbers using simple and weighted average of price relatives.
7. To calculate the Chain Base index numbers.
8. To calculate consumer price index number.
9. Fitting of trend by Moving Average Method
10. Measurement of Seasonal indices Ratio-to-Trend method
11. Measurement of Seasonal indices Ratio-to-Moving Average method
12. Measurement of seasonal indices Link Relative method
13. Calculation of variance of random component by variate difference method
14. Forecasting by exponential smoothing
15. Forecasting by short term forecasting methods.

Semester VI
Design of Experiments

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 missing observations.

UNIT II : Factorial experiments: advantages, notations and concepts, 2^2 , 2^3 factorial experiments, design and analysis, Total and Partial confounding for 2n (n≤5),

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, 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.

Design of Experiments Lab

List of Practical:

1. Analysis of CRD
2. Analysis of RBD
3. Analysis of LSD
4. Analysis of an RBD with one missing observation
5. Analysis of an LSD with one missing observation
6. Analysis of 2^2 and 2^3 factorial in CRD and RBD
7. Analysis of 2^2 and 2^3 factorial in LSD
8. Analysis of a completely confounded two level factorial design in 2 blocks
9. Analysis of a completely confounded two level factorial design in 4 blocks.
10. Analysis of a partially confounded two level factorial design
11. Analysis of a single replicate of 2^n design
12. Analysis of a fraction of 2^n factorial design

Numerical Computing (CC-13)

Credit 6

UNIT I: Introduction. Inaccuracies and Approximations. Interpolation – The problem of interpolation, Finite differences, use of Operators Δ, E.

UNIT II: Newtown's Forward interpolation formula. Newton's backward interpolation formula. Lagrange's interpolation formula. Divided differences. Newton's divided difference formula.

UNIT III: Bivariate interpolation. Numerical differentiation. Numerical integration: Trapezoidal rule. Simpson's one-third rule, Euler-Maclaurin's formula.

UNIT IV: Numerical solution of equations: Method of false position. Newton Raphson method. Method of iteration. Convergence of the iteration method. Convergence of the Newtown-Raphson 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. Gupta S.L. and Nisha Rani: Principles of Real Analysis, Vikas Publ. House Pvt. Ltd., New Delhi, 1995.
B. Sc. Honours (Statistics) 19
4. Appostol T.M.: Mathematical Analysis, Second Edition, Narosa Publishing House, NewDelhi, 1987.
5. Shanti Narayan: A course of Mathematical Analysis, 12th revised Edition, S. Chand & Co. (Pvt.) Ltd., New Delhi, 1987.
6. Singal M.K. and Singal A.R.: A First Course in Real Analysis, 24th Edition, R. Chand & Co., New Delhi, 2003.
7. Bartle, R. G. and Sherbert, D. R. (2002): Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore.
8. Ghorpade, Sudhir R. and Limaye, Balmohan V. (2006): A Course in Calculus and Real Analysis,Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint.
9. Jain,M. K., Iyengar, S. R. K. and Jain, R. K. (2003): Numerical methods for scientific and engineering computation, New age International Publisher, India.
10. Mukherjee, Kr. Kalyan (1990): Numerical Analysis. New Central Book Agency.
11. Sastry, S.S. (2000): Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India Pvt. Ltd., New Del.

Numerical Computing Lab

Practical list:

1. Problem on Inaccuracies and Approximations.
2. Problem on interpolation, Finite differences, Operators Δ, E.
3. Problem based on Newtown's Forward interpolation formula.
4. Problem based on Newton's backward interpolation formula.
5. Problem on Lagrange's interpolation formula, divided differences, Newton's divided difference formula.
6. Problems on Bivariate interpolation.
7. Problems on Numerical differentiation. Numerical integration: Trapezoidal rule. Simpson's one-third rule, Euler-Maclaurin's formula.
8. Numerical solution of equations: Method of false position.
9. Problem on Newton Raphson method.
10. Problem on Method of iteration, convergence of the iteration method, convergence of the Newtown-Raphson method.

Statistical Computing with R language (CC-14)

Credit 6

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: Learn how to load data, plot a graph 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, create, 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

Mathematics II (DSE-I)

Credit 6

Unit 1

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.

Unit 2: Solution of the linear system: Rank of matrix, Solution of linear system by using Gaussian elimination, LU decomposition method.

Unit 3:

Vectorspace: Dimension,orthogonality,projections, Gram-Schmidt orthogonalization.Eigenvalue and Eigen vectors; positive definite matrices. Linear transformations, Hermitian and unitary matrices.

Unit 4 :Vector Calculus: Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates.

Unit 5

Complex Analysis: Differentiation of complex functions, Cauchy Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum Modulus theorem (withoutproof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Mathematical Analysis (DSE-2)

Credit 6

Unit 1:

1. Real number system:

(a) Intuitive idea of numbers. Mathematical operations revisited with their Properties (closure, commutative, associative, identity, inverse, distributive). Sets and Functions - definition and properties (union, intersection, complementation, injection, surjection, bijection).

(b) Field Axioms. Concept of ordered field. Bounded set, L.U.B. (supremum) and G.L.B. (infimum) of a set. Properties of L.U.B. and G.L.B. of sum of two sets and scalar multiple of a set. Least upper bound axiom or completeness axiom. Characterization of IR as a complete ordered field. Definition of an Archimedean ordered field. Archimedean property of IR. Q is Archimedean ordered field but not ordered complete. Linear continuum.

2. Sets in R :

(a) Intervals: Open and closed Intervals, Neighbourhood of a point. Interior point. Open set. Union, intersection of open sets. Every open set can be expressed as disjoint union of open intervals (statement only).

(b) Limit point and isolated point of a set. Criteria for L.U.B. and G.L.B. of a bounded set to be limit point of the set. Bolzano-Weierstrass theorem on limit point.
Definition of derived set. Derived set of a bounded set A is contained in the closed interval [inf A, sup A]. Closed set. Complement of open set and closed set. Union and intersection of closed sets as a consequence. No nonempty proper subset of R is both open and closed.

(c) Dense set in R as a set having non-empty intersection with every open interval. Q and R-Q are dense in R.

3. Sequences of real numbers :

(a) Definition of a sequence as function from N to R. Bounded sequence. Convergence (formalization of the concept of limit as an operation in IR) and non-convergence. Examples. Every convergent sequence is bounded and limit is unique. Algebra of limits.

(b) Relation between the limit point of a set and the limit of a convergent sequence of distinct elements. Monotone sequences and their convergence. Sandwich rule. Nested interval theorem.
Limit of some important sequences.

(c) Subsequence. Subsequential limits. Lim sup upper (limit) and lim inf (lower limit) of a sequence using inequalities. Alternative definitions of lim sup and liminf of a sequence {xn}n using L.U.B. and G.L.B

4. Countability of sets :Countability (finite and infinite) and uncountability of a set. Subset of a countable set is countable. Every infinite set has a countably infinite subset. Cartesian product of two countable sets is countable. Q is countable. Non-trivial intervals are uncountable. IR is uncountable.

5. Continuity of real-valued functions of a real variable :

(a) Limit of a function at a point (the point must be a limit point of the domain set of the function). Sequential criteria for the existence of finite and infinite limit of a function at a point. Algebra of limits. Sandwich rule. Important standard limits.

(b) Algebra of continuous functions as a consequence of algebra of limits. Continuity of composite functions. Examples of continuous functions. Continuity of a function at a point does not necessarily imply the continuity in some neighbourhood of that point.

(c) Bounded functions. Neighbourhood properties of continuous functions regardingboundednessandmaintenanceofsamesign.Continuousfunctionon [a,b] is bounded and attains its bounds. Intermediate value theorem.

Unit 2:

1. Infinite Series of real numbers :

a) Convergence, Cauchy's criterion of convergence.

b) Series of non-negative real numbers : Tests of convergence – Cauchy's condensation test. Comparison test (ordinary form and upper limit and lower limit criteria), Kummer's test. Statements and applications of : Abel – Pringsheim's Test, Ratio Test , Root test, Raabe's test, Bertrand's test, Logarithmic test and Gauss's test.

c) Series of arbitrary terms: Absolute and conditional convergence

d) Alternating series: Leibnitz test (proof needed).

e) Non-absolute convergence: Abel's and Dirichlet's test (statements and applicatins). Riemann's rearrangement theorem (statement only) and rearrangement of absolutely convergent series (statement only).

2. Derivatives of real –valued functions of a real variable :

a) Definition of derivability. Meaning of sign of derivative. Chain rule.

b) Successive derivative: Leibnitz theorem.

c) Theorems on derivatives :Darboux theorem, Rolle's theorem, Mean value theorems of Lagrange and Cauchy – as an application of Rolle's theorem. Taylor's theorem on closed and bounded interval with Lagrange's and Cauchy's form of remainder deduced from Lagrange's and Cauchy's mean value theorem respectively. Maclaurin's theorem as a consequence of Taylor's theorem. Statement of Maclaurin's theorem and the expansion of some standard functions.

d) Statement of L' Hospital's rule and its consequences. Point of local extremum (maximum, minimum) of a function in an interval. Sufficient condition for the existence of a local maximum/minimum of a function at a point (statement only). Determination of local extremum using first order derivative. Application of the principle of maximum/minimum in geometrical problems.

3. Function of two and three variables : Limit and continuity. Partial derivatives. Sufficient condition for continuity. Relevant results regarding repeated limits and double limits.

4. Functions $R^2 \to R$ Differentiability and its sufficient condition, differential as a map, chain rule, Euler's theorem and its converse. Commutativity of the second order mixed partial derivatives : Theorems of Young and Schwarz.

5. Jacobian of two and three variables, simple properties including function dependence. Concept of Implicit function : Statement and simple application of implicit function theorem for two variables Differentiation of Implicit function.

6. Taylor's theorem for functions two variables. Lagrange's method of undetermined multipliers for function of two variables (problems only).

References:

1. BasicReal&AbstractAnalysis–RandolphJ.P.(AcademicPress).
2. AFirstCourseinRealAnalysis–M.H.Protter&G.B.Morrey(Springer Verlag,NBHM).
3. A Course of Analysis –Phillips.
4. Problems in Mathematical Analysis– B. P. Demidovich (Mir).
5. Problems in Mathematical Analysis – Berman(Mir).
6. Differential&IntegralCalculus(Vol.I&II)–Courant&John.
7. Calculus of One Variable – Maron (CBSPublication).
8. IntroductiontoRealAnalysis–Bartle&Sherbert(JohnWiley&Sons.)

MOLECULAR GENETICS (DSE-3)

Credit6

Unit 1 Structures of Genetic Material and Genome organization **No. of Hours: 10**

DNA Structure, Watson and Crick DNA double helix model, DNA structure and Salient features of double helix, Types of DNA, Types of genetic material, denaturation andrenaturation, cot curves. DNA topology, linking number, topoisomerases, Organization of DNA in Chromosome, Mutations and mutagenesis: Definition and types of Mutations; Physical and chemicalmutagens; Molecular basis of mutations; Functional mutants, Reversion and suppression, Ames test, Mutator genes.

Unit 2 Basic molecular regulation of gene **No. of Hours: 12**

DNA replication, Prokaryotic DNA polymerases, Uni-and bi-directional replication, initiation of DNA replication, Okazaki fragments,Termination of replication in E. Coli, Transcription: Prokaryotic RNA polymerases, Sites and assembly of transcription initiation complex, transcription initiation, elongation, termination, Coding, and non-coding RNAs, Regulation of transcription,Operons, Gene regulation, negative and positive gene induction, Synthesis and processing of proteins, Role of tRNA in protein synthesis, Genetic codes, codon, anticodon interactions; Ribosome structure, Initiation of translation, elongation and termination.

Unit 3 Concept of Gene and Inheritance **No. of Hours: 12**

Concept of gene: Allele, multiple alleles, Pseudogenes , Gene families, Gene clusters, Inheritance biology Mendel's experiment, Mono-hybrid cross, Di-hydrid cross Codominance, incomplete dominance, gene interactions, Epistasis,Penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters; Extrachromosomal inheritance (episomes, mitochondria and chloroplast).Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their geneticimplications.Recombination, Homologous and non-homologous.

Unit 4 Mechanisms of Genetic Exchange in Prokaryotes **No. of Hours: 10**

Mechanisms of microbial gene transfer, Transformation, Mechanism of natural competence, Types of plasmids, F plasmid, R Plasmids, Colicinogenic plasmids, Host range, plasmid-incompatibility, Plasmid amplification, Regulation of copy number, curing of plasmids Conjugation - Discovery, mechanism, Hfr and F' strains, Interrupted mating technique and time of entry mapping, Transduction - Generalized transduction, specialized transduction, Mapping by recombination and co-transduction of markers, Genetic basis of lytic versus lysogenic switch of phage lambda, Prokaryotic transposable elements – Insertion Sequences, Replicative and Non replicative transposition.

PRACTICAL:

1. Isolation of genomic DNA from E. coli.
2. Estimation of salmon sperm / calf thymus DNA using colorimeter (diphenylaminereagent) or UV spectrophotometer (A260 measurement).
3. Estimation of RNA using colorimeter (orcinol reagent) or UVspectrophotometer (A260 measurement).
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Preparation of Master and Replica Plates.
6. Study the effect of chemical (HNO2) and physical (UV) mutagens on bacterial cells.
7. Isolation of Plasmid DNA from E.coli.
8. Demonstration of Bacterial Conjugation.
9. Demonstration of bacterial transformation and transduction.
10. Demonstration of AMES test.

SUGGESTED READING

1. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10thEd., Benjamin Cummings
2. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics.8th Ed. Wiley-India 3.Maloy SR, Cronan JE and FriefelderD(2004) Microbial Genetics 2nd EDITION
4. Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed.,Benjamin Cummings
5. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
6. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition,Cold Spring Harbour Laboratory press.

Statistical Computing with C++ (DSE-4)

Credit 6

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).

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 Structure: Definition and declaring, initialization, accessing structure members, copying and comparison of structure variables, array of structures, structure pointers. Dynamic memory allocation functions :malloc, calloc and free. Pre processors: Macro substitution, macro with argument File inclusion in C++: Defining and opening a file (only r, w and a modes), closing a file, I/O operations on files-fscanf and fprintf functions.

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

Statistical Computing with C++ Lab

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