CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

IRINJALAKUDA, THRISSUR - PIN 680 125

COMPLEMENTARY COURSE IN STATISTICS

(CHOICE BASED CREDIT AND SEMESTER SYSTEM)

SYLLABUS

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2016 ONWARDS)

BOARD OF STUDIES IN STATISTICS (UG)
IRINJALAKUDA, THRISSUR PIN 680 125 KERALA

OPEN COURSES

OPEN COURSE 1. ECONOMIC STATISTICS

Module 1: Time series analysis: Economic time series, different components, illustrations, additive and multiplicative models, determination of trends, growth curves, analysis of seasonal fluctuations, construction of seasonal indices
24 hours
Module 2: Index numbers: Meaning and definition-uses and types-problems in the construction of index numbers-simple aggregate and weighted aggregate index numbers. Test for consistency of index numbers-factor reversal , time reversal and unit test, Chain base index numbers-Base shifting-splicing and deflating of index numbers. Consumer price index numbers-family budget enquiry-limitations of index numbers.
30 hours

Books for references

1. S C Gupta and V K Kapoor, Fundamentals of Applied Statistics, Sulthan Chands and sons
2. Goon A M, Gupta M K and Das Gupta, Fundamentals of Statistics Vol II, The World Press, Calcutta

OPEN COURSE 2. QUALITY CONTROL

Module 1: General theory of control charts, causes of variations in quality, control limits, sub-grouping, summary of out-of-control criteria, charts of attributes, np chart, p chart, c chart, Charts of variables: X bar chart, R Chart and sigma chart, Revised control charts, applications and advantages
30 hours
Module 2: Principles of acceptance sampling-problems of lot acceptance, stipulation of good and bad lots-producer' and consumer' risk, simple and

double sampling plans, their OC functions, concepts of AQL, LTPD,AOQL, Average amount of inspection and ASN function
24 hours

References

1. Grant E L, Statistical quality control, McGraw Hill
2. Duncan A J, Quality Control and Industrial Statistics, Taraporewala and sons
3. Montegomery D C, Introduction to Statistical Quality Control, John Wiley and sons

OPEN COURSE 3. BASIC STATISTICS

Module 1: Elements of Sample Survey: Census and Sampling, advantages, principal step in sample survey-sampling and non-sampling errors. Probability sampling, judgment sampling and simple random sampling.
15 hours

Module 2: Measures of Central tendency: Mean, median and mode and their empirical relationships, weighted arithmetic mean-Dispersion: absolute and relative measures, standard deviation and coefficient of variation.
15 hours

Module 3: Fundamental characteristics of bivariate data: univariate and bivariate data, scatter diagram, curve fitting, principle of least squares, fitting of straight line. Simple correlation, Pearson's correlation coefficient, limit of correlation coefficient, invariance of correlation coefficient under linear transformation.
19 hours

Module 4: Basic probability: Random experiment, sample space, event, algebra of events, Statistical regularity, frequency definition, classical definition and axiomatic definition of probability-addition theorem, conditional probability, multiplication theorem and independence of events (limited to three events).
20 hours

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE

Semester	Course	Course Title	Instructional Hours per week	Credit	Exam Hours	Ratio Ext: Int
1	1	BASIC STATISTICS AND PROBABILITY	4	3	3	4:1
2	2	PROBABILITY DISTRIBUTIONS	4	3	3	4:1
3	3	STATISTICAL INFERENCE	5	3	3	4:1
4	4	APPLIED STATISTICS	5	3	3	4:1

COMPLEMENTARY COURSE I: BASIC STATISTICS AND PROBABILITY

Module 1: Population, sample, , measures of central tendency-arithmetic mean, weighted arithmetic mean, geometric mean, harmonic mean, median, mode, partition values-quartile, percentile, measures of deviations-variance, standard deviation, mean deviation about mean, quartile deviation, co-efficient of variation,
20 hours
Module 2: Fitting of straight line, parabola, exponential, polynomial, (least square method), correlation, regression, two regression lines, regression coefficients,properties- .rank correlation, partial and multiple correlation (3 variables)
15 hours
Module 3: Random experiment, Sample space, event, classical definition of probability, statistical regularity, relative frequency definition, field, sigma field, axiomatic definition of probability and simple properties, concept of

probability measure, addition theorem (two and three events), conditional probability of two events, multiplication theorem, independence of events(pair wise and mutual), Bayes theorem. –numerical problems
25 hour

Module 4: Random variable-discrete and continuous, probability mass function (pmf) and probability density function (pdf)-properties and examples, cumulative Distribution function and its properties, change of variable (univariate case)
12 hours

References

5. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
6. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chan and Sons
7. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
8. John E Freund, Mathematical Statistics (6th edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE II- PROBABILITY DISTRIBUTIONS

Module 1: Mathematical expectations (univariate): Definition, raw and central moments (definition and relationships), moment generating function and properties, characteristic function (definition and use only), Skewness and kurtosis (using moments)
15 hours

Module 2: Bivariate random variable: joint pmf and joint pdf, marginal and conditional probability, independence of random variables, function of random variable. Bivariate Expectations, conditional mean and variance, covariance, Karl Pearson Correlation coefficient, independence of random variables based on expectation.
15 hours

Module 3: Standard distributions: Discrete type-Bernoulli, Binomial, Poisson, Geometric, negative binomial (definition, properties and applications), Uniform (mean, variance and mgf), Continuous type-Uniform, exponential, gamma, Beta, Normal (definition, properties and applications), Lognormal, Pareto and Cauchy (Definition only)
30 hours

Module 4:: Chebyshev's inequality, variables, Convergence in probability weak law of large numbers (iid case), Bernoulli law of large numbers, example only), Central limit theorem (Lindberg Levy-iid case)
12 hours

References

9. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
10. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
11. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
12. John E Freund, Mathematical Statistics (6th edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE III. STATISTICAL INFERENCE

Module 1: Sampling distributions: Statistic, Sampling distribution of a statistic, Standard error, Sampling from normal distribution, distribution of sample mean, sample variance;, chi-square distribution, t distribution, and F distribution (definition, derivations and relationships only).
25 hours

Module 2: Theory of Estimation: Point Estimation, desirable properties of a good estimator, unbiasedness, consistency, sufficiency, Fisher Neyman factorization theorem, efficiency.Methods of Estimation:- Method of maximum likelihood, method of moments.
20 hours

Module 3: Interval Estimation: Interval estimates of mean, difference of means, variance, proportions and difference of proportions. Derivation of exact confidence intervals for means, variance and ratio of variances based on normal, t, chi square and F distributions:
15 hours

Module 4: Testing of Hypotheses: concept of testing hypotheses, simple and composite hypotheses, null and alternative hypotheses, type I and II errors, critical region, level of significance and power of a test. Neyman Pearson approach: Large sample tsts concerning mean equality of means, proportions , equality of proportions, Small sample tests based on t distribution for mean, equality of means and paired t test. Tests based on Fdistribution for ratio of variances. Tests based on Chi square distribution for variance, goodness of fit and for independence of attributes:
30 hours

References

V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
S.C.Gupta and V. K. Kapoor Fundamentals of Mathematical Statistics, Sultan Chand and Sons
A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
John E Freund, Mathematical Statistics (6th edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE IV: APPLIED STATISTICS

Module 1:Census and Sampling, Principal steps in a sample survey, different types of sampling, Organisation and execution of large scale sample surveys, errors in sampling (Sampling and nonsampling errors) preparation of questionnaire, simple random sampling with and without replacement, Systematic,stratified and cluster sampling (concept only)
20 hours
Module 2:Analysis of variance; one way, two way classifications. Null hypothesis, total, between and within sum of squares. Assumptions-ANOVA table..
15 hours
Module 3: Time series :Components of time series-additive and multiplicative models, measurement of trend, moving averages, seasonal indices-simple average-ratio to moving average.
Index numbers: meaning and definition-uses and types- problems in the construction of index numbers- different types of simple and weighted index numbers. Test for an ideal index number- time and factor reversal test.
30 hours
Module 4:Statistical Quality Control: Concept of statistical quality control, assignable causes and chance causes, process control. Construction of control charts, 3sigma limits. Control chart for variables-Mean chart and Range chart. Control chart for attributes- pchart, d or np chart and chart
25 hours

References

1. S.C.Gupta and V. K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons
2. Grant E L, Statistical quality control, McGraw Hill

3. Duncan A J, Quality Control and Industrial Statistics, Taraporewala and sons
4. Montegomery D C, Introduction to Statistical Quality Control, John Wiley and sons
5. S.P.Gupta: statistical methods

SYLLABUS OF COMPLEMENTARY II- ACTUARIAL SCIENCE STATISTICS: COMPLEMENTARY – II

CUCCSSUG 2014 (2014 admission onwards)

Sem No	Course code	Course Title	Instructional Hours/week	Credit	Exam Hours	Ratio Ext: Int
1	AS1C01	**FINANCIAL MATHEMATICS FINANCIAL MATHEMATICS**	4	3	3	4:1
2	AS2C02	**FINANCIAL MATHEMATICS**	4	3	3	4:1
3	AS3C03	**LIFE CONTINGENCIES AND PRINCIPLES OF INSURANCE**	5	3	3	4:1
4	AS4C04	**LIFE CONTINGENCIES AND PRINCIPLES OF INSURANCE**	5	3	3	4:1

SEMESTER I
Course I
Financial mathematics

Module I: Rates of interest-Simple and Compound interest rates-Effective

rate of interest Accumulation and Present value of a single payment-Nominal rate of interest-Constant force of interest-Relationship between these rate of interest- Accumulation and Present value of a single payment using these rate of interest- Accumulation and Present value of a single payment using these symbols-When the force of interest is a function of t, δ(t).Definition of A(t1,t2),A(t),v(t1,t2) and v(t).Expressing accumulation and present values of a single payment using these symbols-when the force of interest is a function of t, δ(t) **22hrs**

Module II: Series of payments-Definition of annuity (Ex:-real life situation)-Accumulation and present vales of annuities with level payments and where the payments and interest rates have same frequencies- Definition and derivation –Definition of perpetuity and derivation- Accumulation and present values of annuities where payments and interest rates have different frequencies **22hrs**

Module III: Increasing and decreasing annuities-Definition and derivation—Annuities payable continuously-Annuities where payments are increasing continuously and payable continuously-Definition and derivation **10hrs**

Module IV: Loan schedules-Purchase price of annuities net of tax-consumer credit transaction **18hrs**

Books for study and reference:

Institute of Actuaries Act Ed. *Study materials*
McCutcheon, J.J., Scott William (1986): An introduction to Mathematics of Finance
Butcher,M.V., Nesbit, Cecil. (1971)Mathematics of compound interest, Ulrich's Books
Neill, Alistair, Heinemann, (1977): *Life contingencies.*
Bowers, Newton Let al Actuaries, 2nd Ed

SEMESTER II

Course II Life contingencies

Module I: Survival distribution and Life tables:
Probability for the age at death- life tables- The deterministic survivorship group. Other life table functions, assumptions for Fractional Ages Some analytical laws of mortality select and ultimate life table **25hrs**

Module II: Multiple life functions: Joint life status-the last survivor status-Probabilities and expectations-Insurance and annuity benefits- Evaluation-Special mortality laws-Evaluation-Uniform distribution of death-Simple contingent functions-Evaluation **10hrs**

Module III: Evaluation of assurance:
Life assurance contracts-(whole, n-year term, n-year endowment, deferred) Insurance payable at the moment of death and insurance payable at the end of year of death-Recursion equations- Commutation functions **19hrs**

Module IV: Life annuities: single payment contingent on survival-Continuous life annuities-Discrete life annuities-Life annuities with monthly payment Commutation Function formulae for annuities with level payments-Varying annuities-Recursion equations-complete annuities-immediate and apportion able annuity –due
18hrs

Books for study and reference:
Institute of Actuaries Act Ed. *Study materials*
McCutcheon, J.J., Scott William (1986): An introduction to Mathematics of Finance
Butcher,M.V., Nesbit, Cecil. (1971)Mathematics of compound interest, Ulrich's Books
Neill, Alistair, Heinemann, (1977): *Life contingencies.*
Bowers, Newton Let al (1997): Actuarial mathematics, society of Actuaries, 2nd Ed

SEMESTER III
Course III
Life contingencies and Principles of insurance

Module I: Net premiums: Fully continuous premiums-fully discrete premiums-True mthly payment premiums-Apportion able premiums-Commutation functions-Accumulation type benefits **20hrs**

Module II: Fully continuous net premium reserves-other formulas for fully discrete net premium results-Reserves on semi continuous basis- Reserves based on semi continuous basis-Reserves based on apportion able or discounted continuous basis-Recursive formulae for fully discrete basis-Reserves at fractional duration-Allocation of the loss to the policy years-Differential equation for fully continuous reserves **25hrs**

Module III: Concept of Risk-the concept of Insurance-Classification of Insurance-Types of Life Insurance-Insurance Act, fire ,marine, motor engineering, Aviation and agricultural-Alternative classification-Insurance of property-pecuniary interest, liability &person, Distribution between Life & General Insurance-History of General Insurance in India. **25hrs**

Module IV: The Economic of Insurance: Utility theory-Insurance and Utilityelements of Insurance-optimal insurance-Multiple decrement models **20 hrs**

Books for study and reference:

Institute of Actuaries Act Ed. *Study materials*
McCutcheon, J.J., Scott William (1986): An introduction to Mathematics of Finance
Butcher,M.V., Nesbit, Cecil. (1971)Mathematics of compound interest, Ulrich's Books
Neill, Alistair, Heinemann, (1977): *Life contingencies.*
Bowers, Newton Let al (1997): Actuarial mathematics, society of Actuaries, 2nd Ed

SEMESTER IV

Course IV

Probability models and Risk theory

Module I: Individual risk model for a short time: Model for individual claim random variables-Sums of independent random variable- Approximation for the distribution of the sum-Application to insurance **20hrs**

Module II: Collective risk models for a single period: The distribution of aggregate claims-Selection of basic distributions-Properties of compound Poisson distributions –Approximations to the distribution of aggregate claims **25hrs**

Module III: Collective risk models over an extended period: Claims process-The adjustment coefficient-Discrete time model-The first surplus below the initial level-The maximal aggregate loss **20hr**s

Module IV: Application of risk theory: Claim amount distributions-Approximating the individual model-Stop-loss re-insurance-The effect of re-insurance on the probability of ruin **25hrs**

Books for study and reference:

Institute of Actuaries Act Ed. *Study materials*
McCutcheon, J.J., Scott William (1986): An introduction to Mathematics of Finance
Butcher,M.V., Nesbit, Cecil. (1971)Mathematics of compound interest, Ulrich's Books
Neill, Alistair, Heinemann, (1977): *Life contingencies.*
Bowers, Newton Let al (1997): Actuarial mathematics, society of Actuaries, 2nd Ed

STATISTICS: COMPLEMENTARY – I Syllabus for BSc.

CUCCSSUG 2014 (2014 admission onwards) SYLLABUS FOR BSc. (GEOGRAPHY MAIN)

Sem No	Course code	Course Title	Instructional Hours/week	Credit	Exam Hours	Ratio Ext: Int
1	SG1C01	**STATISTICAL METHODS**	4	3	3	4:1
2	SG2C02	**Regression Analysis, Time Series and Index Numbers**	4	3	3	4:1
3	SG3C03	**PROBABILITY**	5	3	3	4:1
4	SG4C04	**TESTING OF HYPOTHESIS**	5	3	3	4:1

Semester I

Course-I (STATISTICAL METHODS)

Module 1. Meaning, Scope and limitations of Statistics – collection of data, conducting a statistical enquiry – preparation of questionnaire – primary and secondary data – classification and tabulation – Formation of frequency distribution – diagrammatic and graphic presentation of data – population and

sample –advantages of sampling over census – methods of drawing random samples from a finite population. (Only a brief summary of the above topics is intended to be given by the teacher. Detailed study is expected from the part of students). **12hrs**

Module 2. Measures of central tendency – Arithmetic mean-weighted arithmetic mean, medium, mode, geometric mean and harmonic mean, partition values – quartiles – deciles and percentiles**. 30hrs**

Module 3. Measure of dispersion – relative and absolute measures of dispersion, measures of dispersion – range – quartile deviation – mean deviation-standard deviation – Lorenz curve – skewness and kurtosis. **30 hours**

Semester II

Course-II Regression Analysis, Time Series and Index Numbers

Module 1. Fitting of curves of the form – linear, y=abx, y=aebx – correlation analysis – concept of correlation – methods of studying correlation – scatter diagram – Karl Pearson's correlation coefficient – concept of rank correlation and Spearman's rank correlation coefficient – regression analysis – linear regression – regression equations (concepts only – Derivations are beyond the scope of this syllabus). **30hrs**

Module 2. Index numbers, meaning and use of index numbers – simple and weighted Index numbers – price index numbers – Laspeyer's, Paasche's Marshall – Edgeworth and Fisher's index number – Test of good index number, chain base and fixed base index number – construction of cost of living index number. **20hrs**

Module 3. Time series analysis – component of time series – measurement of secular trend semi average, moving average and least square methods (linear function only) concept of seasonal and cyclical variation. **22hours**

Semester III

Course III-PROBABILITY

1. **Module 1.** Probability theory – concept of random experiment, sample point, sample space and events – mathematical and statistical definitions of probability, limitations, axiomatic approach to probability–addition and,

multiplication theorems, concept of conditional probability, probability in discrete sample space – numerical problems. **35 hours**

2. Module 2. Random variable, definition of discrete and continuous type – probability mass function, distribution function – mathematical expectation, definition, numerical problems in the discrete case only. **25 hours**

3. Module 3. One point, two point, Bernoulli, binomial, Poisson. Normal distributions – probability density function, properties – simple numerical problems. **30hrs**

Semester IV

Course-IV-TESTING OF HYPOTHESIS

Module 1. Testing of statistical hypotheses, large and small sample tests, basic ideas of sampling distribution, test of mean, proportion, difference of means, difference of proportions, tests of variance and correlation coefficient, chi squares tests**. 35hours**

Module 2. Non parametric tests – advantages, sign test, run test, signed rank test, rank-sum test. Kolmogorov – Smirnov goodness of fit test. **30 hours**

Module 3. Analysis of variance: One way and two way classifications. Null hypotheses, total, between and within sum of squares. ANOVATable. Solution of problems using ANOVA tables. **25 hours**

Books for reference.

1. S.C. Gupta and V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and sons
2. Mood A.M., Graybill. F.A and Boes D.CIntroduction to Theory of
3. Gibbons J.D.: Non parametric Methods for Quantitative Analysis, McGraw Hill.
4. S.C. Gupta & V.K.Kapoor: Fundamentals of Applied Statistics, Sultan Chand & Sons.
5. Box, G.E.P. and G.M. Jenkins: Time Series Analysis, Holden –Day

STATISTICS: COMPLEMENTARY – I SYLLABUS FOR BSc. PSYCHOLOGY (MAIN)

CUCCSSUG 2014 (2014 admission onwards)

Sem No	Course code	Course Title	Instructional Hours/week	Credit	Exam Hours	Ratio Ext: Int
1	PS1C01	**STATISTICAL METHODS**	4	3	3	4:1
2	PS2C02	**REGRESSION ANALYSIS, AND PROBABILITY**	4	3	3	4:1
3	PS3C03	**PROBABILITY DISTRIBUTIONS AND PARAMETRIC TESTS**	5	3	3	4:1
4	PS4C04	**NON PARAMETRIC TESTS AND ANALYSIS OF VARIANCE**	5	3	3	4:1

Semester-I STATISTICAL METHODS

Module 1. Pre-requisites.

A basic idea about data, its collection, organization and planning of survey and diagramatic representation of data is expected from the part of the students. Classification of data, frequency distribution, formation of a frequency distribution, Graphic representation *viz*. Histogram, Frequency Curve, Polygon, Ogives and Pie Diagram. **20hr**

Module 2. Measures of Central Tendency.

Mean, Median, Mode, Geometric Mean, Harmonic Mean, Combined Mean, Advantages and disadvantages of each average. **20hrs**

Module 3. Measures of Dispersion.
Range, Quartile Deviation, Mean Deviation, Standard Deviation, Combined Standard Deviation, Percentiles, Deciles, Relative Measures of Dispersion, Coefficient of Variation.
Module 4. Skewness and Kurtosis.
Pearson's Coefficient of Skewness, Bowley's Measure, Percentile Measure of Kurtosis. **16hrs**

Books for Study.

1. Gupta, S P (1988). Statistical Methods, Sultan Chand and Sons, New Delhi.
2. Gupta, S C and Kapoor, V K (2002). Fundamentals of Applied Statistics, Sultan
Chand and Sons, New Delhi.
3. Garret, H E and Woodworth, R S (1996). Statistics in Psychology and Education,
Vakila, Feffex and Simens Ltd., Bombay.

COURSE II -SEMESTER-II

REGRESSION ANALYSIS AND PROBABILITY

Module 1. Correlation and Regression.
Meaning, Karl Pearson's Coefficient of Correlation, Scatter Diagram, Calculation of Correlation From a 2-way table, Interpretation of Correlation Coefficient, Rank Correlation,

Module 2. Multiple Correlation and Regression.
Partial and Multiple Correlation Coefficients, Multiple Regression Equation, Interpretation of Multiple Regression Coefficients (three variable cases only). **16h**

Module 3. Basic Probability.
Sets, Union, Intersection, Complement of Sets, Sample Space, Events, Classical, Frequency and Axiomatic Approaches to Probability, Addition and Multiplication Theorems, Independence of Events (Up-to three events). **20hrs**

Module 4. Random Variables and Their Probability Distributions.

Discrete and Continuous Random Variables, Probability Mass Function, Distribution Function of a Discrete Random Variable. **16hrs**

Books for Study.

4. Gupta, S P (1988). Statistical Methods, Sultan Chand and Sons, New Delhi.
5. Gupta, S C and Kapoor, V K (2002). Fundamentals of Applied Statistics, Sultan
Chand and Sons, New Delhi.
6. Garret, H E and Woodworth, R S (1996). Statistics in Psychology and Education,
Vakila, Feffex and Simens Ltd., Bombay.

Semester-III

Course III -PROBABILITY DITRIBUTIONS AND PARAMETRIC TESTS

Module 1. Distribution Theory.
Binomial, Poisson and Normal Distributions, Mean and Variance (without derivations), Numerical Problems, Fitting, Importance of Normal Distribution, Central Limit Theorem. **25hrs**

Module 2. Sampling Theory.
Methods of Sampling, Random and Non-random Sampling, Simple Random Sampling, Stratified, Systematic and Cluster Sampling. **20hrs**

Module 3. Testing of Hypotheses.
Fundamentals of Testing, Type-I & Type-II Errors, Critical Region, Level of Significance, Power, *p*-value, Tests of Significance. Large Sample Tests – Test of a Single Mean, Equality of Two Means, Test of a Single Proportion, Equality of Two Proportions. **25hrs**

Module 4. Small Sample Tests.
Test of a Single Mean, Paired and Unpaired t-Test, Chi-Square Test of Variance, FTest for the Equality of Variance, Tests of Correlation. **20hrs**

Books for Study.

7. Gupta, S P (1988). Statistical Methods, Sultan Chand and Sons, New Delhi.
8. Gupta, S C and Kapoor, V K (2002). Fundamentals of Applied Statistics, Sultan

Chand and Sons, New Delhi.
9. Garret, H E and Woodworth, R S (1996). Statistics in Psychology and Education,
Vakila, Feffex and Simens Ltd., Bombay.

Semester-IV NON-PARAMETRIC TESTS AND ANALYSIS OF VARIANCE

Course IV

Module 1. Chi-square Tests.
Chi-square Test of Goodness of Fit, Test of Independence of Attributes, Test of Homogeneity of Proportions. **25hrs**

Module 2. Non-Parametric Tests.
Sign Test, Wilcoxen's Signed Rank Test, Wilcoxen's Rank Sum Test, Run Test, Krushkal-Wallis Test. **20hrs**

Module 3. Analysis of Variance.
One-way and Two-way Classification with Single Observation Per Cell, Critical Difference. **25hrs**

Module 4. Preparation of Questionnaire, Scores and Scales of Measurement, Reliability and Validity of Test Scores. **20hrs**

Books for Study.

10. Gupta, S P (1988). Statistical Methods, Sultan Chand and Sons, New Delhi.
11. Gupta, S C and Kapoor, V K (2002). Fundamentals of Applied Statistics, Sultan
Chand and Sons, New Delhi.
12. Garret, H E and Woodworth, R S (1996). Statistics in Psychology and Education,
Vakila, Feffex and Simens Ltd., Bombay.