CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA

COMPLEMENTARY COURSE IN STATISTICS

FOR BSC MATHEMATICS, GEOLOGY, COMPUTER SCIENCE

(CHOICE BASED CREDIT AND SEMESTER SYSTEM FOR UNDERGRADUATE CURRICULUM)

UNDER THE FACULTY OF MATHS

SYLLABUS

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2019 – '20 ONWARDS)

BOARD OF STUDIES IN MATHS (UG)

CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA - 680125, KERALA, INDIA

JUNE, 2019

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16	Ms. Sruthi Mohan	Assistant Professor(Adhoc) Christ College (Autonomous) Irinajalakuda

COMPLEMENTARY SYLLABUS FOR

MATHEMATICS, GEOLOGY & COMPUTER SCIENCE

Sem No	Course Code	Course Title	Instructional Hours/week	Credit	Exam Hours	Ratio Ext: Int
1	STA 1C 01	INTRODUCTORY STATISTICS	4	3	2.5	4:1
2	STA 2C 02	PROBABILITY THEORY	4	3	2.5	4:1
3	STA 3C 03	PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY	5	3	2.5	4:1
4	STA 4C 04	STATISTICAL INFERENCE AND QUALITY CONTROL	5	3	2.5	4:1

Question Paper Pattern

Type of Questions	Question number (From….. To …..)	Marks
Short Answer	01 to 15	Each question carries 2 Marks. Maximum Marks that can be scored in this section is 25
Paragraph/ Problems	16 to 23	Each question carries 5 Marks. Maximum Marks that can be scored in this section is 35
Essay	24 to 27	Answer *any two* Questions. Each question carries 10 marks
Total	**01 to 27**	**80**

SEMESTER 1
STA1C01 - INTRODUCTORY STATISTICS

Contact Hours per Week: 4

Number of Credits: 3

Number of Contact hours: 72

Course Evaluation: Internal – 20 Marks + External – 80 Marks

Course Outline

Blue Print for Question Paper Setting / Scrutiny						
Course and course code: STA 1C 01- INTRODUCTORY STATISTICS						
Max. Marks: 80						
Question Paper			Syllabus			
Sections or Parts	Mark	Question Numbers	MODULE 1 7 Hrs 9 Marks	MODULE 2 30 Hrs 51 Marks	MODULE 3 15 Hrs 24 Marks	MODULE 4 20 Hrs 26 Marks
Expected mark >>>>						
A	2	1	2			
		2	2			
		3		2		
		4		2		
		5		2		
		6		2		
		7		2		
		8		2		
		9		2		
		10		2		
		11			2	
		12			2	
		13				2
		14				2
		15				2
B	5	16	5			
		17		5		
		18		5		
		19		5		
		20			5	
		21			5	
		22				5
		23				5
C	10	24		10		
		25		10		
		26			10	
		27				10
Actual Mark >> >>			9	51	24	26

Question Paper setter has to give equal importance to both theory and problems in section B and C.

I. INTRODUCTORY STATISTICS (CODE: STA1C01)

Module 1: Official statistics: The Statistical system in India: The Central and State Government organizations, functions of the Central Statistical Office (CSO), National Sample Survey Organization (NSSO) and the Department of Economics and Statistics. (7 hours)

Module 2: Introduction to Statistics: Nature of Statistics, Uses of Statistics, Statistics in relation to other disciplines, Abuses of Statistics. Concept of primary and secondary data. Designing a questionnaire and a schedule. Concepts of statistical population and sample from a population, quantitative and qualitative data, Nominal, ordinal and time series data, discrete and continuous data. Presentation of data by table and by diagrams, frequency distributions by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods) and ogives. Measures of central tendency (mean, median, mode, geometric mean and harmonic mean) with simple applications. Absolute and relative measures of dispersion (range, quartile deviation, mean deviation and standard deviation) with simple applications. Co-efficient of variation, Box Plot. Importance of moments, central and non-central moments, and their interrelationships. Measures of skewness based on quartiles and moments and kurtosis based on moments.
(30 hours)

Module 3: Correlation and Regression: Scatter Plot, Simple correlation, Simple regression, two regression lines, regression coefficients. Fitting of straight line, parabola, exponential, polynomial (least square method). (15 hours)

Module 4: Time series and Index Numbers: Introduction and examples of time series from various fields, Components of times series, Additive and Multiplicative models. Trend and Seasonal Components: Estimation of trend by linear filtering (simple and weighted moving averages) and curve fitting (polynomial and exponential)

Index numbers: Meaning and definition-uses and types, problems in the construction of index numbers-simple aggregate and weighted aggregate index numbers. (20 hours)

References

1. S.C. Gupta and V. K. Kapoor. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi
2. Goon. A.M, Gupta M.K, Das Gupta. B. Fundamentals of Statistics, Vol-I, the World Press Pvt. Ltd., Kolkata.
3. Hoel P.G. Introduction to mathematical statistics, Asia Publishing house.
4. Chatfield. C. The Analysis of Time Series: An Introduction, Chapman & Hall
5. Statistical System in India, C.S.O.
6. M. R.Saluja : Indian Official Statistics. ISI publications.
7. www.mospi.gov.in
8. www.ecostat.kerala.gov.in

SEMESTER 2
STA2C02 - PROBABILITY THEORY

Contact Hours per Week: 4

Number of Credits: 3

Number of Contact hours: 72

Course Evaluation: Internal – 20 Marks + External – 80 Marks

Course Outline

Blue Print for Question Paper Setting / Scrutiny						
Course and course code: STA 2C 02- PROBABILITY THEORY						
Max. Marks: 80						
Question Paper			Syllabus			
Sections or Parts	Mark	Question Numbers	MODULE 1	MODULE 2	MODULE 3	MODULE 4
			25 Hrs	12 Hrs	15 Hrs	20 Hrs
			28 Marks	26 Marks	28 Marks	28 Marks
Expected mark >>>>						
A	2	1	2			
		2	2			
		3	2			
		4	2			
		5		2		
		6		2		
		7		2		
		8			2	
		9			2	
		10			2	
		11			2	
		12				2
		13				2
		14				2
		15				2
B	5	16	5			
		17	5			
		18		5		
		19		5		
		20			5	
		21			5	
		22				5
		23				5
C	10	24	10			
		25		10		
		26			10	
		27				10
Actual Mark >> >>			**28**	**26**	**28**	**28**

Question Paper setter has to give equal importance to both theory and problems in section B and C.

II. PROBABILITY THEORY (CODE: STA2C02)

Module 1: Introduction to Probability: Random experiment, Sample space, events, classical definition of probability, statistical regularity, field, sigma field, axiomatic definition of probability and simple properties, addition theorem (two and three events), conditional probability of two events, multiplication theorem, independence of events-pair wise and mutual, Bayes theorem and its applications. (25 hour)

Module 2: Random variables: Discrete and continuous, probability mass function (pmf) and probability density function (pdf)-properties and examples, Cumulative distribution function and its properties, change of variables (univariate case only) (12 hours)

Module 3: Mathematical expectations (univaraite): Definition, raw and central moments (definition and relationships), moment generation function and properties, characteristic function (definition and use only), Skewness and kurtosis using moments (15 hours)

Module 4: Bivariate random variables: 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. (20 hours)

References

1. V. K. Rohadgi, 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, Pearson Edn, New Delhi
5. Hoel P.G. Introduction to mathematical statistics, Asia Publishing house.

SEMESTER 3
STA3C03 - PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY

Contact Hours per Week: 5

Number of Credits: 3

Number of Contact hours: 90

Course Evaluation: Internal – 20 Marks + External – 80 Marks

Course Outline

			Blue Print for Question Paper Setting / Scrutiny			
			Max. Marks: 80			
Question Paper			Syllabus			
Sections or Parts	Mark	Question Numbers	MODULE 1 30 Hrs 43 Marks	MODULE 2 25 Hrs 26 Marks	MODULE 3 10 Hrs 13 Marks	MODULE 4 25 Hrs 28 Marks
Expected mark >>>>						
A	2	1	2			
		2	2			
		3	2			
		4	2			
		5		2		
		6		2		
		7		2		
		8			2	
		9			2	
		10			2	
		11			2	
		12				2
		13				2
		14				2
		15				2
B	5	16	5			
		17	5			
		18	5			
		19		5		
		20		5		
		21			5	
		22				5
		23				5
C	10	24	10			
		25	10			
		26		10		
		27				10
Actual Mark >> >>			**43**	**26**	**13**	**28**

Question Paper setter has to give equal importance to both theory and problems in section B and C.

PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY. (CODE: STA3C03)

Equip the students with knowledge of various distributions and to develop greater skills and understanding of various inequalities for further studies.

Understand the basic knowledge of various sampling techniques and sampling distributions.

Module 1: Standard distributions: Discrete type - Bernoulli, Binomial, Poisson, Geometric, Negative Binomial (definition only), Uniform (mean, variance and mgf).

Continuous type - Uniform, exponential and Normal (definition, properties and applications); Gamma (mean, variance, mgf); Lognormal, Beta, Pareto and Cauchy (Definition only) (30 hours)

Module 2: Limit theorems: Chebyshev's inequality, Sequence of random variables, parameter and Statistic, Sample mean and variance, Convergence in probability (definition and example only), weak law of large numbers (iid case), Bernoulli law of large numbers, Convergence in distribution (definition and examples only), Central limit theorem (Lindberg levy-iid case) (25 hours)

Module 3: Sampling methods: Simple random sampling with and without replacement, systematic sampling (Concept only), stratified sampling (Concept only), Cluster sampling (Concept only) (10 hours)

Module 4: Sampling distributions: 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)

References

1. V. K. Rohadgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S. C. Gupta and V. K. Kappor, 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, Pearson Edn, New Delhi
5. William G. Cochran, Sampling Techniques, 3rd Edition, Wiley India Pvt. Ltd

SEMESTER 4
STA4C04 - STATISTICAL INFERENCE AND QUALITY CONTROL

Contact Hours per Week: 5

Number of Credits: 3

Number of Contact hours: 90

Course Evaluation: Internal – 20 Marks + External – 80 Marks

Objective

1. Introduce estimation as well as hypothesis testing in practical life.

2. Introduce parametric and non-parametric test to draw conclusions from the sample.

3. Will be able to draw various types of control charts.

Course Outline

Blue Print for Question Paper Setting / Scrutiny						
			Max. Marks: 80			
Question Paper			Syllabus			
Sections or Parts	Mark	Question Numbers	MODULE 1 30 Hrs 35 Marks	MODULE 2 45 Hrs 30 Marks	MODULE 3 10 Hrs 9 Marks	MODULE 4 20 Hrs 21 Marks
Expected mark >>>>						
A	2	1	2			
		2	2			
		3	2			
		4	2			
		5	2			
		6		2		
		7		2		
		8		2		
		9		2		
		10		2		
		11			2	
		12			2	
		13				2
		14				2
		15				2
B	5	16	5			
		17	5			
		18	5			
		19		5		
		20		5		
		21		5		
		22			5	
		23				5
C	10	24	10			
		25		10		
		26		10		
		27				10
Actual Mark >> >>			43	26	13	28

Question Paper setter has to give equal importance to both theory and problems in section B and C.

IV: STATISTICAL INFERENCE AND QUALITY CONTROL. (CODE: STA4C04)

Module 1: Estimation theory: Parametric space, sample space, point estimation. Nayman Factorization criteria, Requirements of good estimator: Unbiasedness, Consistency, Efficiency, Sufficiency and completeness. Minimum variance unbiased (MVU) estimators. Cramer-Rao inequality (definition only). Minimum Variance Bound (MVB) estimators.

Methods of estimation: Maximum likelihood estimation and Moment estimation methods (Detailed discussion with problems); Properties of maximum likelihood estimators (without proof); Least squares and minimum variance (concepts only).

Interval estimation: Confidence interval (CI); CI for mean and variance of Normal distribution; Confidence interval for binomial proportion and population correlation coefficient when population is normal. (30 hours)

Module 2: Testing of Hypothesis: Level of significance, Null and Alternative hypotheses, simple and composite hypothesis, Types of Errors, Critical Region, Level of Significance, Power and p- values. Most powerful tests, Neyman-Pearson Lemma (without proof), Uniformly Most powerful tests. Large sample tests: Test for single mean, equality of two means, Test for single proportion, equality of two proportions. Small sample tests: t-test for single mean, unpaired and paired t-test. Chi-square test for equality of variances, goodness of fit, test of independence and association of attributes. Testing means of several populations: One Way ANOVA, Two Way ANOVA (assumptions, hypothesis, ANOVA table and problems) (30 hours)

Module 3: Non-parametric methods: Advantages and drawbacks; Test for randomness, Median test, Sign test, Mann-Whiteny U test, Wilcoxon test; Kruskal Wallis test (Concept only) (10 hours)

Module 4: Quality Control: General theory of control charts, causes of variations in quality, control limits, sub-grouping, summary of out-of-control criteria. Charts of variables - X bar chart, R Chart and sigma chart. Charts of attributes – c-charts, p-chart and np-chart. (Concepts and problems). (20 hours)

References

1. V. K. Rohadgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. Gupta, S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.
3. S. C. Gupta and V. K. Kappor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
4. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
5. John E Freund, Mathematical Statistics, Pearson Edn, New Delhi
6. Grant E L, Statistical quality control, McGraw Hill
7. Montegomery D C, Introduction to Statistical Quality Control, John Wiley and sons.

COMPLEMENTARY SYLLABUS FOR PSYCHOLOGY

Sem No	Course Code	Course Title	Instructional Hours/week	Credit	Exam Hours	Ratio Ext: Int
1	STA 1C 02	**DESCRIPTIVE STATISTICS**	4	3	2	4:1
2	STA 2C 02	**REGRESSION ANALYSIS AND PROBABILITY THEORY**	4	3	2	4:1
3	STA 3C 02	**PROBABILITY DISTRIBUTIONS AND PARAMETRIC TESTS**	5	3	2	4:1
4	STA 4C 02	**STATISTICAL TECHNIQUES FOR PSYCHOLOGY**	5	3	2	4:1

Question Paper Pattern

Type of Questions	Question number (From..... To.....)	Marks
Short Answer	01 to 12	Short answer type carries 2 marks each - 12 questions **(Maximum Marks 20)**
Paragraph/ Problems	13 to 19	Paragraph/ Problem type carries 5 marks each –7 questions **(Maximum Marks 30)**
Essay	20 to 21	Essay type carries 10 marks (1 out of 2) **(Maximum Marks 10)**
Total	**01 to 21**	**60**

Question Paper setter has to give equal importance to both theory and problems in sections B and C.

SEMESTER 1
STA1C02 - DESCRIPTIVE STATISTICS

Contact Hours per Week: 4

Number of Credits: 3

Number of Contact hours: 72

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Objective

1. To generate interest in Statistics

2. To equip the students with the concepts of basic Statistics

3. To provide basic knowledge about Statistical methods

Course Outline

Module 1: A basic idea about data- collection of data, primary and secondary data, organization, planning of survey and diagrammatic representation of data (10 Hours)

Module 2: Classification and tabulation- Classification of data, frequency distribution, formation of a frequency distribution, Graphic representation viz. Histogram, Frequency Curve, Polygon, Ogives, Bar diagram and Pie diagram (10 Hours)

Module 3: Measure of central tendency-Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, Combined Mean, Advantages and disadvantages of each average (20 Hours)

Module 4: Measures of dispersion-Range, Quartile Deviation, Mean Deviation, Standard Deviation, Combined Standard Deviation, Percentiles, Deciles, Relative Measures of Dispersion, Coefficient of variation (16Hours)

Module 5: Skewness and Kurtosis-Pearson's and Bowley's coefficient of skewness, Percentile Measure of Kurtosis (16 Hours)

References

1. Gupta, S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.

2. Gupta, S.C., & Kapoor, V.K. Fundamentals of Applied Statistics. New Delhi: Sultan Chand and Sons.

3. Garret, H.E., &Woodworth, R.S. Statistics in Psychology and Education. Bombay: Vakila, Feffex and Simens Ltd.

4. Mood, A.M., Graybill, F.A and Boes, D.C. Introduction to Theory of Statistics.3rd Edition Paperback – International Edition.

5. Mukhopadhyay, P. Mathematical Statistics. New central Book Agency (P) Ltd: Calcutta.

Assignments/ Seminar

Assignments/Seminar are to be given to students. The purpose of the assignments/seminar is to provide practical exposure to the students.

STA2C02 - REGRESSION ANALYSIS AND PROBABILITY THEORY

Contact Hours per Week: 4

Number of Credits: 3

Number of Contact hours: 72

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Objective

1. To make the students aware of various Statistical tools

2. To create awareness about probability

Course Outline

Module 1: Bivariate data- relationship of variables, correlation analysis, methods of studying correlation, Scatter Diagram, Karl Pearson's Coefficient of Correlation, Calculation of Correlation from a 2-way table, Interpretation of Correlation Coefficient, Rank Correlation (11 Hours)

Module 2: Regression analysis- linear regression, Regression Equation, Identifying the Regression Lines properties of regression coefficients, numerical problems (9 Hours)

Module 3: Partial and Multiple Correlation Coefficients- Multiple Regression Equation, Interpretation of Multiple Regression Coefficients (three variable cases only) (16 Hours)

Module 4: 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) (20 Hours)

Module 5: Random Variables and their probability distributions- Discrete and Continuous Random Variables, Probability Mass Function, Distribution Function of a Discrete Random Variable (16 Hours)

References

1. Gupta S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.

2. Gupta S.C., &Kapoor, V. K. Fundamentals of Applied Statistics. New Delhi: Sultan Chand and Sons.

3. Garret H.E., &Woodworth, R.S. Statistics in Psychology and Education. Bombay: Vakila, Feffex and Simens Ltd.

4. Mood, A.M., Graybill, F.A and Boes, D.C. Introduction to Theory of Statistics.3rd Edition Paperback – International Edition.

5. Mukhopadhyay, P. Mathematical Statistics. New central Book Agency (P) Ltd: Calcutta.

Assignments/ Seminar

Assignments/Seminar are to be given to students. The purpose of the assignments/seminar is to provide

practical exposure to the students.

SEMESTER 3
STA3C03 - PROBABILITY DISTRIBUTIONS AND PARAMETRIC TESTS

Contact Hours per Week: 4

Number of Credits: 3

Number of Contact hours: 90

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Objective

1. To get a general understanding on various probability distributions
2. To familiarize the uses of Statistical test.

Course Outline

Module 1: Distribution Theory- Binomial, Poisson and Normal Distributions, Mean and Variance (without derivations), Numerical Problems, Fitting, Importance of Normal Distribution, standard normal distribution, simple problems using standard normal tables, Central Limit Theorem (Concepts only) (25 Hours)

Module2: Methods of Sampling- Random Sampling, Simple Random Sampling, Stratified, Systematic and Cluster Sampling, Non-Random sampling, Subjective sampling, Judgment sampling and convience sampling (20 Hours)

Module 3: Fundamentals of Testing- Type-I & Type-II Errors, Critical Region, Level of Significance, Power, pvalue, Tests of Significance (15 Hours)

Module 4: Large Sample Tests–Test of a Single, Mean Equality of Two Means, Test of a Single Proportion, and Equality of Two Proportions (10 Hours)

Module 5: Small Sample Tests-Test of a Single Mean, Paired and Unpaired t-Test, Chi- Square Test of Variance, F-Test for the Equality of Variance, Tests of Correlation (20 Hours)

References

1. Gupta, S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.
2. Gupta, S.C., &Kapoor, V. K. Fundamentals of Applied Statistics. New Delhi: Sultan Chand and Sons.
3. Garret, H.E., &Woodworth, R.S. Statistics in Psychology and Education. Bombay: Vakila, Feffex and Simens Ltd.
4. Mood, A.M., Graybill, F.A and Boes, D.C. Introduction to Theory of Statistics.3rd Edition Paperback – International Edition.
5. Mukhopadhyay, P. Mathematical Statistics. New central Book Agency (P) Ltd: Calcutta.

Assignments/ Seminar

Assignments/Seminar are to be given to students. The purpose of the assignments/seminar is to provide practical exposure to the students.

SEMESTER 4
STA4C02 - STATISTICAL TECHNIQUES FOR PSYCHOLOGY

Contact Hours per Week: 5

Number of Credits: 3

Number of Contact hours: 90

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Objective

1. To make the students aware of various Statistical test in different areas of Psychology

2. To give knowledge about applications of Statistics in different areas of Psychological studies.

Course Outline

Module 1: Analysis of Variance-assumptions, One-way and Two-way Classification with Single Observation per Cell, Critical Difference (20 Hours)

Module 2: Non-Parametric Tests-Chi-square Test of Goodness of Fit, Test of Independence of Attributes, Test of Homogeneity of Proportions (20 Hours)

Module 3: Sign Test- Wilcoxon's Signed Rank Test, Wilcoxon's Rank Sum Test, Run Test and Krushkal-Wallis Test (20 Hours)

Module 4: Factorial Design- Basics of factorial Design, Factorial experiments and their uses in Psychological studies, Concepts of 22, 23 factorial experiments (without derivation), simple problems (15 Hours)

Module 5: Preparation of Questionnaire- Scores and Scales of Measurement, Reliability and Validity of Test Scores (15Hours)

References

1. Gupta, S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.

2. Gupta, S.C., &Kapoor, V.K.Fundamentals of Applied Statistics. New Delhi: Sultan Chand and Sons.

3. Garret, H.E., &Woodworth, R.S. Statistics in Psychology and Education. Bombay: Vakila, Feffex and Simens Ltd.

4. Mood, A.M., Graybill, F.A and Boes, D.C. Introduction to Theory of Statistics.3rd Edition Paperback – International Edition.

5. Douglas C. Montgomery. Design and Analysis of Experiments.9th Edition.

Assignments/ Seminar

Assignments/Seminar are to be given to students. The purpose of the assignments/seminar is to provide practical exposure to the students.

OPEN CORSE

ECONOMIC STATISTICS

Module 1. Time Series analysis: Economic time series, different components, illustrations, additive and multiplicative models, determination of trend, 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 of consistency of index numbers- factor reversal- time reversal test 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 reference

1. SC Gupta and V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand & Sons
2. Goon A.M., Gupta M.K. and Das Gupta: Fundamentals of Statistics Vol.II The World Press, Calcutta.