UNIVERSITY OF CALICUT

SUBJECT: DRAFT SYLLABUS OF BSc. STATISTICS

This is the complete syllabus of BSc. STATISTICS, Core and Complementary which is discussed and approved by the Undergraduate Board of Studies, STATISTICS. I submit the syllabus for active suggestions, modifications, corrections and evaluations from the teaching fraternity and other subject experts. Your valuable suggestions can be conveyed to the following persons.

Venugopalan pk venunairstat@gmail.com

Dr.Chacko V M chackovm@gmail.com

Sasidharan pk sasipkl@gmail.com

Dr.Hamsa hamsaulliyeri@gmail.com

Ahamedkutty K M statpsmo@gmail.com

Dr.Jenson P O jenson2752669@gmail.com

Dr. Seemon seemonpala@rediffmail.com

Sherly Sebastian Sebastian_sherly@yahoo.com

Mercy joseph mersu@rediffmail.com

Thanking you,

Yours sincerely,

Venugopalan. P.K

Chairman,

Board of studies, STATISTICS (U.G)

University of Calicut.

Associate Professor in Statistics,

Sreekeralavarma college , Thrissur

Ph;09446940610

Thrissur 11/02/2014

SYLLABUS FOR B.Sc. STATISTICS-SEMESTER SYSTEM (DRAFT)

CCSS 2014 (2014 ONWARDS)

1. **CORE COURCES**
2. **ELECTIVE COURSES**
3. **OPEN COURSES**
4. **COMPLEMENTARY COURSES**

COURSE DETAILS

1. **CORE COURSES**

Semester	Course	Course Title	Instructional Hours per week	Credit	Exarm Hours	Ratio Ext: Int
1	1	BASIC STATISTICS AND PROBABILITY	4	4	3	3:1
2	2	BIVARIATE RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS	4	4	3	3:1

3	3	STATISTICAL ESTIMATION	5	4	3	3:1
4	4	TESTING OF HYPOTHESIS	5	4	3	3:1
5	5	MATHEMATICAL METHODS IN STATISTICS	5	4	3	3:1
5	6	STATISTICAL COMPUTING	5	4	3	3:1
5	7	SAMPLE SURVEYS	5	4	3	3:1
5	8	OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL	5	4	3	3:1
5		OPEN COURSE OFFERED BY OTHER FACULTIES	3	4	3	3:1
6	9	TIME SERIES AND INDEX NUMBERS	5	4	3	3:1
6	10	DESIGN OF EXPERIMENTS	5	4	3	3:1
6	11	POPULATION STUDIES AND ACTURIAL SCIENCE	5	4	3	3:1
6	12	LINEAR REGRESSION ANALYSIS	5	4	3	3:1
6	13	PRACTICAL				
5-6		PROJECT WORK	4	4		

2.ELECTIVE COURSES

Semester	Course	Course Title	Instructional Hours per week	Credit	Exarm Hours	Ratio Ext: Int
6	1	ACTURIAL SCIENCE-	3	2	3	3:1

		PROBABILITY MODELS AND RISK THEORY				
6	**2**	**STOCHASTIC MODELLING**	**3**	**2**	**3**	**3:1**
6	**3**	**RELIABILITY THEORY**	**3**	**2**	**3**	**3:1**

3. OPEN COURSES

Semester	Course	Course Title	Instructional Hours per week	Credit	Exarm Hours	Ratio Ext: Int
5	**1**	**ECONOMIC STATISTICS**	**3**	**4**	**3**	**3:1**
5	**2**	**QUALITY CONTROL**	**3**	**4**	**3**	**3:1**
5	**3**	**BASIC STATISTICS**	**3**	**4**	**3**	**3:1**

4. COMPLEMENTORY COURSES

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

CORE COURSE I: BASIC STATISTICS AND PROBABILITY

Module 1: 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.

15 hours

Module 2: Random experiment, Sample space, event, 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.

25 hours

Module 3: 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).

15 hours

Module 4: Fitting of straight line, parabola, exponential, polynomial, (least square method), correlation-Karl Pearson's Correlation coefficient, Rank Correlation-Spearman's rank correlation co-efficient, Partial Correlation, Multiple Correlation, regression, two regression lines, regression coefficients.

17 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 (6^{th} edn), Pearson Edn, NewDelhi

CORE COURSE 2. BIVARIATE RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS

Module 1: Bivariate random variable, joint pmf and joint pdf, marginal and conditional probability, independence of random variables, function of random variable.

15 hours

Module 2: Mathematical expectations-definition, raw and central moments (definition and relationships), moment generation function and properties, characteristic function (definition and use only), covariance and correlation.

20 hours

Module 3: Skewness and kurtosis using moments, Bivariate case-conditional mean and variance, covariance, Karl Pearson Correlation coefficient, independence of random variables based on expectation.

12 hours

Module 4: 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)

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 (6^{th} edn), Pearson Edn, NewDelhi

CORE COURSE 3. STATISTICAL ESTIMATION

Module 1: Limit Theorems: Chebyshev's inequality, Sequence of random variables, 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 example only), Central limit theorem (lindberg levy-iid case)

30 hours

Module 2: Sampling distributions: Parameter, Statistic, standard error, Sampling from normal distribution: distribution of sample mean, sample variance, chi-square, T–distribution, and F distribution (definition, property and relationships only).

20 hours

Module 3: Estimation of Parameter: Test statistic, Sufficient Statistic, Nayman Factorization criteria (Statement only), Unbiased Statistic, Consistency, Efficiency, Method of`finding estimator-moment estimator, maximum likelihood estimator (MLE).

25 hours

Module 4: Interval Estimation: Confidence interval(CI), CI for mean and variance of Normal distribution, CI of proportion.

15 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 (6^{th} edn), Pearson Edn, NewDelhi

CORE COURSE 4. TESTING OF HYPOTHESIS

Module 1: Parametric Test: Level of significance, simple and composite hypothesis, Type of errors, power, Most powerful tests, Nayman-Pearson Lemma, Uniformly Most powerful tests, likelihood ratio tests.

30 hours

Module 2: Testing mean, proportion and variance: one sample and two sample t-test, z-test, paired t-test, chi-square test, F-test.

25 hours

Module 3: General tests: Test for goodness of fit-chi-squared test, chi-square test for independence of attributes-contingency tables, test for homogeneity.

15 hours

Module 4: Nonparametric tests: Kolmogrov Smirnov one sample and two sample tests, sign test, Wilcoxen signed rank test, Median test, Mann Whitney-Wicoxen test.

20 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 (6^{th} edn), Pearson Edn, NewDelhi

CORE COURSE 5. MATHEMATICAL METHODS IN STATISTICS

Module 1: Real Number system: Mathematical induction, order properties of real number, Bernoulli, Cauchy, triangle inequality, absolute value, Completeness property-suprema & infima, Archimedian property, Density theorem, nested interval property.

20 hours

Module 2: Sequences: Limit, limit theorems, Squeeze theorem, convergence of sequence, root test and ratio test, monotone convergence theorem, subsequence and Bolzano-Weierstrass theorem, Cauchy criterion, limits of functions, limit theorems of functions,

25 hours

Module 3: Continuous functions: Definition, Boundedness theorem, Maximum-minimum theorem, Location of roots theorem, Intermediate value theorem, uniform continuity, Differentiation, Interior extremum theorem, Rolle's theorem, Mean value theorem, Taylor's theorem.

25 hours

Module 4: Riemann Integration: Definition, Integrability criteria, integrability of continuous and monotone functions, properties of integrals, first and second fundamental theorems on integral calculus.

20 hours

Books of references

1. Malik S.C. and Savitha Arora, Real Analysis, New Age International
2. Robert G Bartle, Real Analysis, Wiely
3. Shanti Narayanan, Elements of Real Analysis

CORE COURSE 6. STATISTICAL COMPUTING

Module 1: Introduction to R: R as a calculator, statistical software and a programming language, R preliminaries, getting help, data inputting methods(direct and importing from other spread sheet applications like Excel), data accessing, and indexing, Graphics in R, built in functions, saving, storing and retrieving work.

15 Hours

Module 2: Descriptive statistics:, diagrammatic representation of univariate and bivariate data (box plots, stem and leaf diagrams, bar plots, pie diagram, scatter plots), measures of central tendency (mean, median and mode), partition values, measures of dispersion (range, standard deviation, mean deviation and inter quartile range), summaries of a numerical data, skewness and kurtosis, random sampling with and without replacement.

25 Hours

Module 3: Probability Distributions: R as a set of statistical tables- cumulative distribution, probability density function, quantile function, and simulate from the distribution, plotting probability curves for standard distributions.

15 Hours

Module 4: Statistical Inference: classical tests: One- and two-sample tests, z-test, t-test,F-test, chi-square test of independence and goodness of fit, interval estimation for mean, difference of mean and variance, tests for normality (shapiro-wilks test, wilcoxon's test and q-q plot), Anova(one- way and two-way), correlation and regression analysis(bivariate and multivariate data), polynomial regression

25 Hours

References:

1. Michale J. Crawley, THE R BOOK, John Wiley & Sons, England (2009)
2. Sudha G. Purohit et.al., Statistics Using R, Narosa Publishing House, , India(2008)
3. John Verzani, simple R-Using R for Introductory Statistics, (http://www.math.csi.cuny.edu/Statistics/R/SimpleR/Simple.)
4. W. N. Venables, D. M. Smith and the R Core Team, An Introduction to R , Notes on R: A Programming Environment for Data Analysis and Graphics, Version 2.15.2 (2012-10-26) (http://www.r-project.org)

CORE COURSE 7. SAMPLE SURVAYS

Module 1: Census and Sampling, principal steps in sample survey-probability sampling, judgment sampling, organization and execution of large sample surveys, sampling and non-sampling errors, preparation of questionnaire

20 hours

Module 2: Simple random sampling with and without replacement- methods of collecting simple random samples, unbiased estimate of the population mean and population total-their variances and estimate of these variances-simple random sampling for proportions

20 hours

Module 3: Stratified random sampling: estimation of population mean and total, proportional and Neymann allocation of sample sizes-cost function-optimum allocation considering cost-comparison with simple random sampling.

20 hours

Module 4: Systematic Sampling: Linear and circular systematic sampling, comparison with simple random sampling.

10 hours

Module 5: Cluster sampling: Clusters with equal sizes-estimation of the population mean and total, comparison with simple random sampling, two stage cluster sampling-estimate of variance of population mean.

20 hours

Books for references

1. Murthy M N, Sampling theory and methods, Statistical Publishing society, Culcutta
2. Daroja Singh and F S Chaudhary, Theory and Analysis of Sample Survey Designs, Wiely Estrn Limitted
3. Cochran W.G, Sampling Techniques, Wiely Estern

CORE COURSE 8. OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL

Module 1: Linear programming: Mathematical formulation of LPP, Graphical and Simplex methods of solving LPP-duality in linear programming

20 hours

Module 2: Transportation and assignment problems, North-west corner rules, row column and least cost method-Vogel's approximation method, Assignment problem, Hungarian algorithm of solution

20 hours

Module 3: 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

25 hours

Module 4: Principles of acceptance sampling-problems and 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

25 hours

Books for references

1. Gupta and Manmohan, Linear programming, Sulthan Chand and sons
2. Hardley G, Linear programming, Addison-Wesley
3. Taha, Operations Research, Macmillan,
4. V.K.Kappoor, Operations Research, Silthan Chand and Sons
5. S.C.Gupta and V.K.Kappor, Fundamentals of Applied Statistics, Sulthan Chand and Sons

OPEN COURSE OFFERED BY OTHER FACULTY

CORE COURSE 9. TIME SERIES AND INDEX NUMBERS

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.

25 hours

Module 2: Analysis of Income and allied distributions-Pareto distribution, graphical test, fitting of Pareto's law, illustrations, lognormal distribution and properties, Lorenz curve, Gini's coefficient

20 hours

Module 3: 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

Module 4: Attitude Measurements and Scales: issues in attitude measurements-scaling of attitude-Guttman scale-Semantic differential scale-Likert scale-selection of appropriate scale-limitations of scales

15 hours

Books for refrences

1. SC Guptha and V K Kapoor, Fundamentals of applied statistics, Sulthan chand and sons
2. Goon A M Gupta M K and Das Gupta, Fundamentals of Statistics Vol II, The World press, Culcutta
3. Box G E P and Jenkins G M, Time series analysis, Holden Day
4. Meister David, Behavioral Analysis and Measurement methods, John Wiley New York
5. Luck et al. Marketting Research, Prentice Hall of India, New Delhi
6.

CORE COURSE 10. DESIGNS OF EXPERIMENTS

Module 1: Linear estimation, estimability of parametric functions and BLUE-Gauss-Markov theorem-Linear Hypothesis

25 hours

Module 2: Analysis of variance, one way and two way classification (with single observation per cell), Analysis of covariance with a single observation per cell.

25 hours

Module 3: Principles of design-randomization-replication-local control, Completely randomized design, Randomized block design-Latin square design. Missing plot technique-comparison of efficiency.

25 hours

Module 4: Basic concepts of factorial experiments, 2^3 factorial experiments, Duncan's multiple range test.

15 hours

Books for references

1. S.C. Gupta and V K Kapoor, Fundamentals of applied Statistics, Sulthan Chand and Sons
2. Federer, Experimental Designs
3. M N Das and N Giri, Design of Experiments, New Age interenational,

4. DD Joshy, linear Estimation and Design of Experiments, Wiley Estearn
5. Montgomeri, Design of Experiments

CORE COURSE 11. POPULATION STUDIES AND ACTURIAL SCIENCE

Module 1: Sources of vital statistics in India-functions of vital statistics, Rates and ratios-mortality rates-crude, age specific and standard death rates-fertility and reproduction rates-crude birth rates-general and specific fertility rates-gross and net reproduction rates.

20 hours

Module 2: Life Tables-complete life tables and its characteristics-Abridged life tables and its characteristics, principle methods of construction of abridged life tables-Reed Merrel's method

40 hours

Module 3: Fundamentals of insurance: Insurance defined meaning of loss, peril, hazard and proximate cause in insurance, Costs and benefits of insurance to society-branches of insurance. Insurable loss exposures-feature of loss that is deal of insurance, Construction of Mortality table-computation of premium of life insurance for fixed duration and for the whole life.

30 hours

Books for reference

1. S.C. Gupta and V K Kapoor, Fundamentals of applied Statistics, Sulthan Chand and Sons
2. Benjamin B, Health and Vital Statistics, Allen and Unwin
3. Mark S Dorfman, Introduction to Risk Management and Insurance, Prentice Hall
4. C.D.Daykin, T. Pentikainen et al, Practical Risk Theory of Acturies, Chapman and Hill

CORE COURSE 12. REGRESSION ANALYSIS

Module 1: Least Square estimation: Gauss-Markoff Setup, Normal equations and least square Method of estimation, properties of estimator, variance of estimator, Estimation of variance.

25 hours

Module 2: Linear Regression: Simple linear regression model, least square estimation of parameters, Hypothesis testing of slope and intercept, co-efficient of determination.

20 hours

Module 3: Multiple Regression: Model, estimation of model parameters, test for significance of regression, regression co-efficient, co-efficient of determination, use of anova

25 hours

Module 4: Polynomial and logistic regression: Models and method of estimation, logistic regression-binary-model and estimates

20hours

References

1. **D C. Montegomerry, E A Peak and G G Vining, Introduction to Linear regression analysis, Wiley 2003**

ELECTIVE COURSE 1. PROBABILITY MODELS AND RISK THEORY

Module 1: Individual risk model for a short time: Model for individual claim random variables-sums of independent random variables-Approximation for the distribution of sum-Application to insurance

10 hours

Module 2: Collective risk models for a single period: The distribution of aggregate claims-selection of basic distributions-properties of compound Poisson distribution-approximation to the distributions of aggregate claims

15 hours

Module 3: Collective risk models over an extended period: Claims process-The adjustment coefficients-Discrete time model-the first surplus below the initial level-The maximal aggregate loss

15 hours

Module 4: 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

14 hours

Books for reference

1. Institute of Acturies, Act Ed. Study Materials
2. McCutcheon, JJ, Scott William (1986): An introduction to Mathematics of Finance
3. Butcher M V, Nesbit, Cecil (1971) Mathematics of Compound Interest, Ulrich's book
4. Neil, Alistair, Heinemann (1977) Life contingencies
5. Bowers, Newton Let et al (1997) Acturial mathematics, society of Acturies, 2nd

ELECTIVE COURSE 2. STOCHASTIC MODELLING

Module 1: Concept of mathematical modeling, definition, natural testing a informal mathematical representations.

10 hours

Module 2: Concept of stochastic process, probability generating functions, convolution generating function of sum of independent random variables, Definition of a stochastic process, classification, Markov chain, transition probabilities, Chapmann and Kolmogrov equations, transition probability matrices, examples and computation.

30 hours

Module 3: First passage probabilities, classification of states, recurrent, transient and ergodic states, stationary distribution, mean ergodic.

14 hours

Books for reference

1. V K Rohadgi, An introduction to probability theory and mathematical statistics, Wiley eastern
2. S M Ross, An Introduction to Probability Theory and Stochastic Models
3. V K Rohadgi Statistical Inference, Wiley Eastern

ELECTIVE COURSE 3. RELIABILITY THEORY

Module 1: Structural properties of coherent Systems: System of components-series and parallel structure with example-dual structure function-coherent structure-preservation of coherent system in terms of paths and cuts-representation of bridge structure-times to failure-relative importance of components-modules of coherent systems.

20 hours

Module 2: Reliability of Coherent systems: Reliability of a system of independent components-some basic properties of system reliability-computing exact system reliability-inclusion exclusion method-reliability importance of components

20 hours

Module 3: Parametric distributions in reliability: A notion of ageing (IFR and DFR only) with examples-exponential distribution-Poisson distribution.

14 hours

Books for references

1. R E Barlow and F Proschan (1975) Statistical Theory of Reliability and life testing, Holt Rinhert, Winston
2. N Ravi Chandran, Reliability Theory, Wiley EasterN

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 Guptha and V K Kapoor, Fundamantals of Applied Statistics, Sulthan and Chands and sons

2. Goon A M, Guptha M K and Das Guptha, Fundamentals of Statistics Vol II, The World Press, Culcutta

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. 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 (6^{th} edn), Pearson Edn, NewDelhi

COMPLIMENTARY COURSE I: BASIC STATISTICS AND PROBABILITY

Module 1: Population, sample, Data, Histogram, 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, Box Plot.

20 hours

Module 2: Fitting of straight line, parabola, exponential, polynomial, (least square method), correlation, regression, two regression lines, regression coefficients.

15 hours

Module 3: Random experiment, Sample space, event, 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.

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. Rohadgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
6. S.C.Gupta and V. K. Kappor, Fundamentals of Mathematical Statistics, Sultan Chand 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 (6^{th} edn), Pearson Edn, NewDelhi

COMPLIMENTARY COURSE II PROBABILITY DISTRIBUTIONS

Module 1: 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 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.

20 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)

20 hour

Module 4: 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 example only), Central limit theorem (lindberg levy-iid case)

17 hours

References

9. V. K. Rohadgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
10. S.C.Gupta and V. K. Kappor, 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 (6^{th} edn), Pearson Edn, NewDelhi

COMPLIMENTARY COURSE III. STATISTICAL INFERENCE

Module 1: 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).

20 hours

Module 2: Estimation of Parameter: Sufficient Statistic, Nayman Factorization criteria, Unbiased Statistic, Consistency, Efficiency, Method of `finding estimator-moment estimator, maximum likelihood estimator (MLE).

20 hours

Module 3: Interval Estimation: Confidence interval (CI), CI for mean and variance of Normal distribution, CI of proportion, Shortest CIs.

15 hours

Module 4: Test of Hypothesis: Level of significance, simple and composite hypothesis, Type of errors, power, Most powerful tests, Nayman-Pearson Lemma(without proof), Uniformly Most powerful tests, chi-square test for goodness of fit, chi-square test for equality of variance, one sample and two sample t-test, paired t-test, F-test.

17 hours

References

V. K. Rohadgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

S.C.Gupta and V. K. Kappor, 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 (6^{th} edn), Pearson Edn, NewDelhi

COMPLIMENTARY COURSE IV: APPLIED STATISTICS

Module 1: Sampling methods: Simple random sampling with and without replacement, systematic sampling (Concept only), stratified sampling (Concept only), Cluster sampling (Concept only)

10 hours

Module 2: Testing mean of several populations: One Way ANOVA, Two Way ANOVA-assumptions, hypothesis and anova table.

15 hours

Module 3: Time Series Analysis and Index numbers: Components of Time series, Moving average (MA) process, Index numbers: Meaning and definition-uses and types, problems in the construction of index numbers-simple aggregate and weighted aggregate index numbers.

20 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 attributes, np chart, p chart, c chart, Charts of variables: X bar chart, R Chart and sigma chart.

22 hours

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 (6^{th} edn), Pearson Edn, NewDelhi
5. Grant E L, Statistical quality control, McGraw Hill
6. Duncan A J, Quality Control and Industrial Statistics, Taraporewala and sons
7. Montegomery D C, Introduction to Statistical Quality Control, John Wiley and sons

PRACTICAL

Numerical questions from the following topics of the syllabi are to be asked for external examination of this paper. The questions are to be evenly chosen from these topics.

1. Small sample test

2. Large Sample test
3. Construction of confidence intervals
4. Sample surveys
5. Design of Experiments
6. Construction of Control charts
7. Linear programming
8. Numerical Analysis
9. Time series
10. Index numbers

The students have to maintain a practical record. The numerical examples of the following topics are to be done by the students of the sixth semester class under the supervision of the teachers and to be recorded in the record book. The valuation of the record shall be done internally

1. Small sample test
2. Large sample test
3. Construction of confidence intervals
4. Numerical analysis
5. Sample surveys
6. Design of experiments
7. Construction of control charts
8. Linear programming
9. Time series

PROJECT

The following guidelines may be followed for project work.

1. The project is offered in the fifth and sixth semester of the degree course and the duration of the project may spread over the complete year.

2. A project may be undertaken by a group of students, the maximum number in a group shall not exceed 5. However the project report shall be submitted by each student.
3. There shall be a teacher from the department to supervise the project and the synopsis of the project should be approved by that teacher. The head of the deparment shall arrange teachers for supervision of the project work.
4. As far as possible, topics for the project may be selected from the applied branches of statistics, so that there is enough scope for applying and demonstrating statistical skills learnt in the degree course.

   Reference

   1. C R Kothari, Introduction to Research Methodology, New Age int
   2. P L Bhandarkar and T S Wilkinson, Methodology and techniques in social research, Himalaya