From

Venugopalan. P.K

Chairman,

Board of studies, STATISTICS (U.G)

University of Calicut.

To

The Digital Wing,

University of Calicut.

Reference: Circular No. 57446/GA IV-J2/2013/CU dated 07/02/2014

Subject: Uploading of draft syllabus of BSc. STATISTICS in the university website

Respected Sir,

I am forwarding you the completed syllabus of Bsc.Statistics, Core and Complementary which is discussed and approved by the Undergraduate Board of Studies, STATISTICS. The syllabus can be uploaded in the university website for suggestions, corrections and evaluations from the teaching fraternity and other subject experts.

Thanking you,

Yours sincerely,

Venugopalan. P.K

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Associate Professor in Statistics,

Sreekeralavarma college Thrissur

Ph;09446940610

Thrissur

26/06/2014

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

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Mercy joseph mersu@rediffmail.com

Thanking you,

Yours sincerely,

Venugopalan. P.K

Chairman,

Board of studies,STATISTICS (U.G)

University of Calicut.

Ph;09446940610

SYLLABUS FOR B.Sc. STATISTICS-SEMESTER SYSTEM (DRAFT)
CCSS 2014 (2014 ONWARDS)

1. CORE COURSES
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	5	4	3	3:1

		EXPERIMENTS				
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-PROBABILITY MODELS AND RISK THEORY	3	2	3	3:1
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

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. 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

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, Neyman 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, Neyman-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 SURVEYS

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, Sultan Chand and Sons
5. S.C.Gupta and V.K.kapoor Fundamentals of Applied Statistics, Sultan Chand and Sons

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 references

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, Calcutta
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. Marketing Research, Prentice Hall of India, New Delhi

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 international,
4. DD Joshy, linear Estimation and Design of Experiments, Wiley Eastern
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 COURSES

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 Actuaries, 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) Actuarial mathematics, society of Actuaries, 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 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 Guptha and V K Kapoor, Fundamentals 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, 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. 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 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

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. Kippur, 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 (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, Neyman 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, Neyman-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. 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 (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

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
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 department 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.

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	3:1
2	AS2C02	**FINANCIAL MATHEMATICS**	4	3	3	3:1
3	AS3C03	**LIFE CONTINGENCIES AND PRINCIPLES OF INSURANCE**	5	3	3	3:1
4	AS4C04	**LIFE CONTINGENCIES AND PRINCIPLES OF INSURANCE**	5	3	3	3:1

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, $\delta(t)$.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, $\delta(t)$ **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	3:1
2	SG2C02	**Regression Analysis, Time Series and Index Numbers**	4	3	3	3:1
3	SG3C03	**PROBABILITY**	5	3	3	3:1
4	SG4C04	**TESTING OF HYPOTHESIS**	5	3	3	3:1

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

Complementary I

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	3:1
2	PS2C02	**REGRESSION ANALYSIS, AND PROBABILITY**	4	3	3	3:1
3	PS3C03	**PROBABILITY DISTRIBUTIONS AND PARAMETRIC TESTS**	5	3	3	3:1
4	PS4C04	**NON PARAMETRIC TESTS AND ANALYSIS OF VARIANCE**	5	3	3	3:1

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.