BHARATHIAR UNIVERSITY::COIMBATORE-641 046
B. Sc. STATISTICS WITH COMPULSORY DIPLOMA IN ACTUARIAL STATISTICS
CBCS PATTERN
(For the students admitted from the academic year **2008-2009** and onwards)
Scheme of Examination

Part	Study Components	Course title	Ins. hrs/ week	Dur.Hrs	CIA	Marks	Total Marks	Credit
	Semester I							
I	Language – I		6	3	25	75	100	3
II	English – I		6	3	25	75	100	3
III	Core Paper I - Descriptive Statistics-I		3	3	25	75	100	4
III	Core Paper II- Descriptive Statistics-II		3	3	25	75	100	4
	Core Practical-1 (using computers – MS – Excel)		2	-	-	-	-	-
III	Allied A : Paper I - Mathematics for Statistics-I		8	3	25	75	100	5
IV	Environmental Studies #		2	3	-	50	50	2
	Semester II							
I	Language – II		6	3	25	75	100	3
II	English – II		6	3	25	75	100	3
III	Core Paper III Time series, Index Numbers and Psychological Statistics		5	3	25	75	100	4
III	Core Practical-I (using computers – MS – Excel)		2	3	40	60	100	3
III	Allied A: Paper II Mathematics for Statistics-II		9	3	25	75	100	5
IV	Value Education – Human Rights #		2	3	-	50	50	2
	Semester III							
I	Language – III		6	3	25	75	100	3
II	English – III		6	3	25	75	100	3
III	Core Paper IV- Demographic methods		3	3	25	75	100	4
III	Core Paper V- Probability Distribution-I		3	3	25	75	100	4
III	Allied B - Paper I - Computer programming for Statistical Analysis-I		5	3	20	55	75	4
	Allied Practical (C & C++ programming)		2	-	-	-	-	-
IV	Skill based Subject - Actuarial Statistics - I		3	3	25	75	100	3
IV	Tamil @ / Advanced Tamil# (OR) Non-major elective - I (Yoga for Human Excellence)# / Women's Rights#		2	3	75		75	2

	Semester IV						
I	Language – IV	6	3	25	75	100	3
II	English – IV	6	3	25	75	100	3
III	Core Paper VI - Probability Distribution-II	4	3	25	75	100	4
	Practical	2	3	40	60	100	3
III	Allied B : Paper II – Computer programming for Statistical Analysis-II	5	3	20	55	75	4
III	Allied Practical (C & C++ programming)	2	3	20	30	50	2
IV	Skill based Subject 2 - Actuarial Statistics - II	3	3	25	75	100	3
IV	Tamil @ /Advanced Tamil # (OR) Non-major elective -II (General Awareness #)	2	3		75	75	2
	Semester V						
III	Core Paper VII- Statistical inference-I	5	3	25	75	100	4
III	Core Paper VIII- Basic Sampling theory	5	3	25	75	100	4
III	Core Paper IX- Design of Experiments	5	3	25	75	100	4
	Core Practical III(Using statistical software package)	2	3	-	-	-	-
III	Core Paper XII- Numerical Mathematics	5	3	25	75	100	4
III	Elective I	5	3	25	75	100	5
IV	Skill based Subject 3 - Actuarial Statistics - III	3	3	25	75	100	3
	Semester VI						
III	Core Paper X - Statistical inference -II	5	3	25	75	100	4
III	Core Paper XIV Statistical Quality Control	5	3	25	75	100	4
	Core Practical-III (Using statistical software package)	2	3	40	60	100	3
III	Elective II	5	3	25	75	100	5
III	Elective III	5	3	25	75	100	5
	Practical-IV (Using Calculator)	5	3	40	60	100	3
IV	Skill Based Subject 4 - Actuarial Statistics - IV	3	3	25	75	100	3
V	Extension Activities @	-	-	50	-	50	1
	Total					3800	140

@ No University Examinations. Only Continuous Internal Assessment (CIA)

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List of Elective papers (Colleges can choose any one of the paper as electives)		
Elective – I	**A**	Operations Research I
	B	Mathematical Economics I
	C	COBOL Programming
Elective – II	**A**	Elements of Econometrics
	B	Indian Official Statistics
	C	Genetical Statistics
Elective - III	**A**	Operations Research II
	B	Mathematical Economics II
	C	Quantitative Techniques for Managerial decisions

SEMESTER-I   **Core paper-I**

SUBJECT TITLE: DESCRIPTIVE STATISTICS -I

Subject description:
        This course introduces the historical development of Statistics, presentation of data, descriptive measurers and fitting mathematical curves to the data

Goal: To enable the students understand and apply descriptive measures in Statistics.

Objective: On successful completion of the course students should have:
        known the history of Statistics and
        learnt data presentation in various forms

UNIT-1
        Origin, scope, limitations and misuse of Statistics-Collection-Classification- Tabulation of data. Diagrammatic representation of data: one dimensional and two dimensional diagrams – graphic representation: line diagram, frequency polygon, frequency curve, histogram and Ogive curves.

UNIT-II
        Measures of central tendency: Mean, Median, Mode, Geometric mean and Harmonic mean-Partition values: Quartiles, Deciles and Percentiles-Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation – Coefficient of variation.

UNIT-III
        Moments- measures of Skewness-Pearson's and Bow ley's Coefficient of skewness, Coeffcient of Skewness based on moments – Kurtosis.

UNIT-IV
        Curve fitting: principle of least squares, fitting of the curves of the form y = a+ bx, $y = a + bx + cx^2$ and curves transformable to the above form.

UNIT-V
        Case study and problems relating to all the above units

Books recommended for study:

1. Mills, F.C   : Statistical Methods-part I
2. Tara Yamane   : Elements of Statistics
3. Guptha, S.C and Kapoor V.K   : Fundamentals of Mathematical Statistics

SEMESTER-I   **Core paper-II**

Subject title: Descriptive statistics -II

Subject description:
 This course introduces measurement of relationship in respect of quantitative and qualitative
 data and the concept of probability.

Goal: To enable the students understand the descriptive measures and probability

Objective:
              On successful completion of the course, students should have
               understood correlation, regression and probabilities of events.

UNIT-I
         Linear correlation-scatter diagram, Pearson's coefficient of correlation, correlation in a
bivariate table, Rank correlation, Coefficient of concurrent deviation- Regression equations -
properties of regression coefficients.

UNIT-II
          Association of attributes: Relation between class frequencies, consistency of data,
independence of attributes, criterion of independence, association of attributes: Yule's coefficient
of association, Yule'coefficient of colligation.

UNIT-III
          Probability: sample space-Concepts of events- Algebraic operations on events-
Definitions of probability.

UNIT-IV
Generalized addition and compound Theorems of probability-independent events –Conditional
probability –Baye's Theorem.

UNIT-V
     Case study and problems related to all the above units

Books recommended for study:
1. Statistical Methods-part I by MILLS, F.C
2. Elements of Statistics by   Tara Yamane
3. Fundamentals of Mathematical Statistics by Guptha, S.C and Kapoor V.K

SEMESTER-II   Core paper-III
Subject title: Time series, Index Numbers and Psychological Statistics.

Subject description:
This course introduces the basic Statistical tools in time related variables, economic variables and Psychology

Goal: To enable the students understand index numbers and other Statistical tools applied to Psychological and chorological data

Objective: On successful completion of the course, the students should have: learnt to measure and analyze the data relating to economics and psychology.

Unit-I :(Time series)
Concept –components of time series –additive and multiplicative models-Resolving components of a time series-measuring trend: Graphic, semi-averages, moving average and principle of least squares methods .

UNIT-II: (Time series)
Seasonal variation- measuring seasonal variation: method of simple averages, ratio to trend method, ratio to moving average method and link relative method- Cyclical and Random fluctuations- variate difference method.

UNIT-II: (Index Numbers)
Index numbers and their definitions - construction and uses of fixed and chain based index numbers-simple and weighted index numbers - Laspeyre's, Paache's, Fisher's, and Marshall-edge-worth index numbers – optimum tests for index numbers-Cost of living index numbers.

UNIT-IV :(Psychological Statistics)
Percentile curve and percentile ranks-their uses –combination and comparision of examination scores-Norms and scaling procedures-The T scale C scale scaling of tests-Reliability of measurements- method of measuring reliability –Internal consistency reliability –item validity-special correlation methods.

UNIT-V
Case study and problems related to all the above units.

Books recommended for study:
1. Applied general statistics by Croxton, F.E   & cowden, D.J (Prentice Hall)
2. Fundamentals of applied Statistics by Goon, A.M, Guptha, Das Guptha, B
3. Fundamentals of applied Statistics by Guptha S.C and Kapoor, V.K (S.chand &Co)
4. The advanced theory of Statistics by Kendall, M.G and Stuart, A Vol III (Charles criffin)
5. Fundamental statistics in Psychology and education by Guilford T.K

SEMESTER-II   **Core practical-I**

Descriptive Statistics I&II   (Using computers MS-Excel)

1. Formation of frequency distribution. Calculation of arithmetic, geometric mean, median and mode .Calculation of percentile.

2. Formation of charts and diagrams: Histogram, bar diagram, Pie diagram frequency line, scatter diagram .Formation of Ogive curves.

3. Calculation of measures of dispersion: Range, Variance, Standard Deviation, Mean deviation, Quartiles.

4. Calculation of Skewness and kurtosis.

5. Problems related to curve fitting.

6. Calculation of correlation and regression coefficients and formation of regression lines

7. Fitting straight line, non-linear trend lines and calculation of trend values using moving averages .

8. Calculation of Index numbers.

Note: students should have exposure in MS -Excel

Three questions are to be answered out of **five** questions.

> For problems: 80 marks
> For record: 20 marks
> Total   :   100 marks

SEMESTER-III   **Core paper-IV**

Subject title: DEMOGRAPHIC METHODS

Subject description: This course introduces the concepts, methods and analysis of data relating to vital events such as births, deaths… marriage… migration ….

Goal: To enable the students to have an exposure on the application of Statistical methods to analyze the demographic problems.

Objective: On successful completion of the course the students should have understood about registered information of vital events, measurement of the events such as birth and death rates, life tables and population projection techniques.

Unit-I:
Demography –definition-sources of demographic data-population census -demographic surveys-Registration method: vital registration-population register and other administrative records-registration of population in India.

Unit-II:
Fertility measurements –crude birth rates-general, specific and total fertility rates-gross and net reproduction rates and their interpretation.

Unit-III:
 Mortality measurements: crude death rate- specific death rate-standardized death rate-infant mortality rate –maternal mortality rate –case fertility rate-comparative mortality index –force of mortality –graduation mortality rates-Makeham's law.

Unit-IV:
Description and construction of various columns of a life table and their relationships-construction
of an abridged life table –Reid and Pearl method-uses life table –migration-factors effecting migration-gross and net migration rates.

Unit-V:
Population projection –population estimates and projection –arithmetic geometric and exponential growth rates- logistics curve and its suitability for graduating population data-Basic ideas of stationary and stable population

Books for study:
1) Indian Population Problems by Agarwala, S.N (Tata Mc Graw Hill, Bombay)
2) Fundamentals of StatisticsVol.II by Goon A.M Guptha,M.K and Das Guptha (world press)
3) Fundamentals of Applied Statistics by Guptha ,S.C and Kapoor ,V.K (S.Chand &Co)
4) An introduction to the study of population by Mishra D.E (South India publishers, Madras)
5) Fundamentals of Demography by DR.Hansraj (Surjeet publications Delhi)
6) Principles of Population studies by Asha A .Bende and Tara karitkar (Himalaya publishing

SEMESTER-III   Core paper-V

Subject title: PROBABILTY AND DISTRIBUTIONS-I

Subject description: This course introduces the various concepts, functions and properties and theorems related to random variables.

Goal: To enable the students to understand and study random phenomena mathematically

Objective: On successful completion of the paper the students should have understood the concepts of random variable, discrete ,continuous, joint, marginal, conditional probability functions, expectation, conditional expectation and variance, generating

functions, law of large numbers and central limit theorem and their applications.

Unit-I:
Random variables –discrete and continuous random variables –distribution function-properties-probability mass function and probability density function –various statistical measures of continuous probability distribution.

Unit-II:
Joint, marginal and conditional distribution functions and density functions- independence of random variables –Transformation of variables (one and two dimensional-concepts only).

Unit-III:
Mathematical expectation-properties-addition and multiplication therorems-cauchy-schwartz inequality, conditional expectation and conditional variance.

Unit-IV:
Moment generating function, cumulant generating function, characteristic function and their properties.

Unit-V:
Tchebychev's inequality, convergence in probability, weak law of large numbers and central limit theorem

Books for study;
1. Fundamentals of Mathematical statistics by Guptha, S.C &Kapoor, V.K (Sulthan chand &sons)
2. Introduction to Mathematical statistics by Hogg.R.V and and Craig ,A.G. (Amerin

SEMESTER-III   ALLIED II –Paper I

Subject title: COMPUTER PROGRAMMING FOR STATISTICAL ANALYSIS-1 (C PROGRAMMING)

Subject description: This course introduces structured high level Computer programming Language C

Goal: To enable the students to understand and develop programs in C.

Objective: On successful completion of this course the students should have obtained the capability to develop programs for Statistical problems.

UNIT-I:
Introduction to C – Sample programs – Basic structure of C programs – Programming style – Constant, Variables and data types: Character set- C tokens – key words and identifiers – Declaration of variables – Assigning values to variables.

UNIT – II:
Operators – Arithmetic, Relational, Logical, Assignment, Increment and Decrement ,
Conditional, Bitwise – Expression – Arithmetic expression – Evaluation of expressions – Type
conversion in expression – Mathematical function – Managing input and output operator –
Reading a character, writing a character, formatted input and output.

UNIT- III:
Decision making and Branching: decision making with – IF statement – Simple IF statement –
IF… ELSE statement – Switch statement – ?: Operator – GOTO statement – Looping : WHILE
statement – DO Statement – FOR statement – Jumps in Loop – Function, classification of
functions – Defining and declarations of functions.

UNIT – IV:
Array – One dimensional and two dimensional arrays – Initializing two dimensional array –
handling of character strings – declaring and initializing string variables – string handling
functions. Pointers – accessing the address of a variable – declaring and initializing pointers –
accessing a variable through its pointers – pointers and arrays- Pointer expression.

UNIT – V:
 Structure : Definition – structure initialization- arrays of structures- Files – defining , opening
and closing of a file. Input / output operations on files – Error handling during Input / Output
operations-Random Access to files – Simple programs based on statistics.

Books for study:
  1. Programming in ANSI C by Balagurusamy, E (Tata Mgraw Hill)
  2. Let us C by Yaswant Kanetker (BPBpublications New Delhi)

SEMESTER III   DIPLOMA PAPER- I

SUBJECT TITLE: ACTUARIAL STATISTICS – I

Subject description: This course introduces the underlying principles, history of life insurance
Goal: To enable the students to understand the sound financial line insurance.
Objective: On completion of this course the students should have understood the principal terms
used and major life insurance products covered in Indian life insurance.

Unit – I: Principles of Life Assurance: Nature of Insurance – Classification of Insurance –
History of Life Insurance in India.
Unit – II: Definition of whole life assurance –term assurance- pure endowment-endowment
assurance – critical illness assurance – whole life level annuity-temporary level annuity-
premium ,benefit – assurance and annuity   contracts.

Unit – III: Derivation of means and variances of the present values of the payment under simple
assurance and annuity contracts assuming constant deterministic interest – simple   problems.

Unit IV: Expression in the form of sums for the mean and variance of the present values of benefit payments under simple assurance and annuity contract in terms of the curtate random future life time, assuming that death benefits are payable at the end of the year of death and annuities are paid annually in advance.

Unit V: Derivation of the relations between annuities payable in advance and in arrear, between temporary, deferred and whole life annuities.

Books for study:
 CT-5 General Insurance, Life and Health contingencies by Institute of Actuaries of India

SEMESTER IV   CORE PAPER VI

SUBJECT TITLE: PROBABILITY AND DISTRIBUTIONS – II

Subject description: This course introduces probability functions for random variables that are defined for different probabilistic situations.

Goal: To enable the students to understand the properties and applications of various probability functions

Objective: On successful completion of the course the students should have understood the applications and nature of the probability distributions such as binomial ,poisson ….normal, t,χ^2 and F.

Unit I:
 Binomial, Poisson and Negative-Binomial distributions – Moments, m.g.f, cumulants, additive property, recurrence relation for the probabilities- simple problems.

Unit II:
Geometric distribution – moments, m.g.f – Hyper-geometric distribution- mean, variance, m.g.f, Binomial as a limiting form of Hyper- geometric distribution – Multinomial distribution – moments

Unit III:
Normal distribution – limiting form of Binomial distribution, properties, median, mode, moments, m.g.f, cumulants, mean deviation, area property, simple problems – Rectangular distribution-moments, m.g.f. characteristic function, mean deviation – Bivariate normal distribution.

Unit IV:
 Gamma, Beta distributions of I kind and II kind   – constants – Exponential distribution – additive property.

Unit V :
Functions of normal random variable leading to χ^2, t and F distributions – inter relationship between the distributions and their properties.

Reference
1. Fundamentals of mathematical statistics By Gupta, S.C and Kapoor, V.K.,(Sultan chand & sons)
2 Introduction to Mathematical Statistics, Hogg R.V and Craig, A.G., (Amerind.)

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SEMESTER-IV   CORE PRACTICAL-II
(Calculator based)

DEMOGRAIC METHODS, PROBABILTY AND DISTRIBUTIONS-I&II

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<u>Demographic methods:</u>
1. Construction of life table.
2. Determination of mortality, fertility and reproduction rates.
3. Population projection using polynomials and exponential function.
4. Fitting Gompertz curve.
5. Fitting logistic curve to population data by the method of Pearl and Reed.
6. Fitting of Logistic curve by Rhodes method.
<u>Probability and Distributions I&II</u>
1 . Fitting of Binomial distribution.
2 Fitting of Poisson distribution.
3. Fitting of Normal distribution by the method of ordinates.
4. Fitting Normal distribution by area method.

Three questions are to be answered out of **five** questions

For problems: 80   marks
For record   : 20   marks
Total   : 100   marks

SEMESTER-IV   ALLIED II-PAPER II

SUBJECT TITLE: COMPUTER PROGRAMMING FOR STATISTICAL ANALYSIS-II
(OBJECT ORIENTED PROGRAMMING WITH C++)

Subject description: This course introduces the concept of object oriented programming language
                        which is a higher version of C programming language
Goal: To enable the students to understand and develop programs in C++.

Objective: On successful completion of this course the students should have obtained the
             capability to develop programs for Statistical problems using OOP's concept

Unit – I:
        Principles of OOP, Basic concepts of OOP– Benefits and application of OOP – C++ structure – tokens , expressions and control structures and functions.

Unit – II:
        Classes and object – Functions prototyping – call by reference – return by reference – Inline functions – functions overloading – Friend and virtual functions – specification of class – member function – private member functions – Arrays within class – memory allocation for objects – array of objects – static and constant member functions.

Unit – III:
        Constructors, Destructors and operator overloading: Constructors – parameterized constructors – copy constructor – Dynamic constructors – Destructors – Definition of operator overloading – overloading binary operators – manipulation of strings using operators – Rules for overloading operators.

Unit – IV:
        Inheritance, Pointers, Virtual functions and polymorphism. Derived classes, single and multiple inheritance, hierarchical and hybrid inheritance, virtual base classes, Abstract classes, Pointers to objects, pointer to derived classes, virtual functions.

Unit – V:
        Files and Templates: File operations **–** Templates, class templates, function templates, member function templates.

Books for study:
        1) Object oriented programming with C++ by Balagrursamy,E (Tata McGraw Hill)
        2) Programming with C++ by D.Ravichandran (Tata McGraw

SEMESTER-IV   **ALLIED II -PRACTICAL**

(C&C++ PROGRAMMING)

Problems:
1. Program to form a frequency distribution for the given data $x_1, x_2, x_3 ...., x_n$, give the number of class intervals K and the width of the class intervals W.
2**.** Program to find the arithmetic mean, geometric mean and harmonic mean for the given frequency distribution.
3. Program to find Mean, Variance, Standard Deviation and Coefficient of variation.
4. Program to find the three quartiles Q1, Q2 and Q3 and the coefficient of skewness.
5**.** Program to find the first four moments about origin A and to find β_1, β_2, γ_1 and γ_2.
6. Program to find simple correlation and regression coefficients for the given bivariate data.
7**.** Program to fit a straight line of the form y = ax + b using the principle of least squares to the given bivariate data.
8. Program to fit Binomial distribution.
9. Program to fit a Poisson distribution.
10**.** Program to arrange one dimensional array of numbers in ascending and descending order.
11. Program to evaluate a matrix polynomial of the type $aX^2+bX+cI$ where X is a matrix of order 3 x 3 and I is an identity matrix and a , b and c are constants.
12**.** Program to solve the given system of simultaneous equations of three variables.
13. Program to open a file and store data in it and to read and display the data from the file
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For problems:	40	marks
For record :	10	marks
Total :	50	marks

Two questions to be answered with internal choice one from C and one from C++

SEMESTER-IV
DIPLOMA PAPER II

SUBJECT TITLE: ACTUARIAL STATISTICS – II

Course number: **Number of credit hours: 3(Three)**

Subject description: This course introduces the types of life insurance products and   premium calculations

Goal: To enable the students to gain more knowledge in life insurance products.

Objective: On completion of this course the students should have under stood various concepts relating to insurance policy

Unit - I: Calculation of Premium – net single premium, deferred annuities, calculation of level premiums, calculation of Gross Premium, Expanses on the basis of variation – distribution of the expanses over the period of policy.

Unit – II: Calculation of net premium reserves of simple insurance contracts using ultimate or select mortality, net random future loss under an insurance contract – principle of equivalence.

Unit – III: Types of life Insurance products – Development of new products – comparative and analytical study of various plans of LIC of India – plans under whole life – plans under money back – plan under term assurance – products introduced in the current year.

Unit – IV: Policy document – need and format – schedule, attestation, duplicate policy – non-forfeiture options – revival – assignment, nomination- loan, surrenders, foreclosure – policy claims – reinsurance – export of policy.

Unit – V: Surrender value – losses of calculation – forms of payment – valuation and surplus – sources of surplus – surplus and profit – bonus option – policy conditions.

Books for Study:
1) MN. Mishra and S.B. Mishra, Insurance Principles
    and practice, S.Chand & Co, New Delhi.
2) Ready Reckoner for LIC premiums, Garuda Publications.
3) IC-02 (Revised) Practice of life assurance by S.Balchandran
     Insurance Institute of India
4) CT-5 General Insurance, Life and health   contingencies, Institute
   of Actuaries of India.

Semester V   **Core Paper VII**

Subject title: STATISTICAL INFERENCE – I

Subject description: This course introduces concepts, methods and properties relating to
                estimation

Goal: To enable the students to understand and apply various estimation procedures

Objective: on successful completion of this course the students should have understood the
          concepts of Point estimation and interval estimation, and their properties, calculation
           of partial and multiple correlation coefficients and multiple linear regression line.

Unit I
        Concept of Statistical Inference- Parametric estimation- Sampling distribution - Standard Error. Derivation of Standard Error of mean, variance, proportion, difference between means variances and Proportions-concept of ordered statistics.

Unit   II

Point Estimation: Estimator, properties of point estimator – unbiasedness, consistency, Crammer Rao inequality – efficiency – asymptotic efficiency and sufficiency of the estimator – Rao Blackwell theorem.

Unit III

Methods of point estimation: method of maximum likelihood, method of minimum chi-square and method of moments - properties of estimators obtained by these methods (Without proof).

Unit IV

Interval Estimation: Fiducial limits-derivation of confidence intervals based on Normal,'t' χ^2 and F distributions. Confidence intervals- using Cramer – Rao inequality-Partial and multiple correlation and regression coefficients – Multiple linear regression lines.

Unit V

Numerical problems in interval estimation, multiple and partial correlation and regression. –simple problems only

Books for study:
1. Introduction to mathematical statistics by Hoel P.G : (Wiley International)
2. Statistical methods by Snedecor, GW and Cochran, WG (Oxford and I B H)
3. Introduction to mathematical   Statistics by Hogg V and Craig .R (Amerind)
4. Theory and application of Statistics Vol. II   by Ramasamy, M.M   :
5. Introduction to Mathematical Statistics   by Brunk, H.D (Ginn and Co.)
6. A first Course in Mathematical Statistics   by Weather Burn CE (Cambridge University press)

SEMESTER-V   CORE PAPER-VIII

SUBJECT TITLE: BASIC SAMPLING THEORY

Subject description: This course introduces the concept, methods and analysis of sampling techniques
Goal: To enable the students to understand and apply the sampling procedures to different situations
Objective: On successful completion of the course the students should have understood sample and census surveys, errors that occur in surveys and various sampling methods and the different types of populations to which these sampling methods are applicable.

Unit-I:
Sampling from a finite population –Random sampling –simple sampling with and without replacement –unbiased estimates of the mean and the variance of the population and of the variance of the estimator of the mean - Estimation of the sample size.

Unit-II: Stratified sampling – proportional and optimum allocation with regard to stratified random sampling-unbiased estimates of the mean and the variance of the population and of the variance of the estimator of the mean.

Unit-III:
 Systematic sampling –Unbiased estimates of the mean and the variance of the population and of the variance of the estimator of the mean.

Unit-IV:
  Cluster and two stage sampling –unbiased estimates of the mean and variance of the population and of the variance of the estimator of the mean.

Unit-V:
 Design, organization and execution of sample surveys –sampling and non-sampling errors and methods to deal with sampling errors.

Books for study:
1. Sampling Techniques by Cochran, W.G (Wiley Est)
2. Sampling theory of survey with applications by Sukathme P.V and sukathme B.V (Asia pub.House)
3. Sampling theory and Methods by Murthy, M.N (Statistical publishing

SEMESTER-V   CORE PAPER-IX

SUBJECT TITLE: DESIGN OF EXPERIMENTS

Subject description: This course introduces various experimental designs, selection of
                    appropriate designs in planning a scientific experimentation
Goal: To enable the students to understand the principles of experimentation and employ suitable
        designs in experiments

Objective: On successful completion of this course the students should have understood the concept of analysis of variance, to compare more than two treatments with the help of F distribution for various designs employed, to estimate missing observations, to compare the efficiencies of various designs and the concept of ANCOVA

Unit-I:
 Linear design models-Least Square estimates of parameters and variance of estimates –Analysis of variance: One way and two way classifications.

Unit-II:
 Fundamentals of experimentation: Plot and pen techniques –determination of shape and size of plots – Uniformity trials –Replication, randomization and local control techniques

Unit-III:
Analysis of different experiments: CRD, RBD and LSD and their efficiencies

UNIT-IV:
Missing plot techniques (atmost two values)-Analysis of covariance (ANCOVA) with one concomitant variable to CRD and RBD.
Unit-V:
Factorial designs -2^2,$2^3$and 3^2 factorial designs with and without confounding.

Books for study:
1. Experimental designs by Cochran W.G and Cox G.M (john Wiley)
2. Experimental design: Theory and applications by Federar, WT (Oxford and IBH)
3. Statistical theory in research by Anderson RL and Bangrtt TA (McGraw HILL)
4. The design of Analysis of Experiments by Kempthrone,B (Wiley Eastern)
5. Fundamentals of Statistics by Goon, A.M., Guptha M.K and Das Guptha (World press)
6. Design and Analysis of Experiments by Das, M.N., and Giri, N.L (wiley Eastern)

SEMESTER V   CORE PAPER X
SUBJECT TITLE: NUMERICAL MATHEMATICS

Subject description: This course introduces the concepts and methods to analyze numerical data

Goal: To enable the students to establish mathematical functions using numerical data

Objective: On successful completion of the course the students will be able to estimate functional relationship, interpolate and extrapolate the value of dependent variable, find maxima and minima using differentiation, and integral value of the estimated function and sum the given series

Unit I
         Finite differences – difference of a polynomial, factorial polynomial- Interpolation for equal intervals – Newton-Gregory forward and backward interpolation formulae.

Unit II
         Central difference interpolation formulae, Gauss forward and backward formulae, Stirling's, Bessel's and Laplace – Everett's formulae, summation of series.

Unit III
         Interpolation for unequal intervals: Newton's divided difference formula and Lagrange's formulae, Inverse interpolation.
Unit IV
         Numerical differentiation and integration- Numerical differentiation up to second order, maxima and minima- Numerical integration : Trapezoidal, Simpson's 1/3 rd and 3/8th rules

Unit V

Iterative method of Eigen vales – Power method, Jacobi method, Solution of system of Non- Linear equations – Newton – Rapson method.

References
1. Introductory Methods of Numerical Analysis by Sastry, SS (1998), (Prinitce Hall of India, New Delhi. Third Edn),
2. Numerical Methods by Kandasamy. P. Thilagavathy,. K and Gunavathy.K (2003), S.Chand & Co, New Delhi.

SEMESTER –V   DIPLOMA PAPER III
(FOR THE B.SC. STATISTICS STUDENTS ADMITTED DURING 2007-08 AND ONWARDS)
SUBJECT TITLE: ACTUARIAL STATISTICS – III
Course number: **Number of credit hours: 3(Three)**

Subject description: This paper introduces business, economic and political environments relating to Indian life insurance.

Goal: To enable the students to have exposure on various acts relating to insurance business environment.

Objective: On completion of this course the students should have
understood the effect of general insurance business environment in India
including the impact of level of risk to the insurer.

Unit–I: Insurance Business Environment – Regularity Environment – Insurance act 1938- Insurance regularity and development authority act 1999, LIC of India act 1956, and General Insurance Business act 1972– Legal Environment – Motor vehicles act 1939 - The public liability insurance act 1991- The Indian steam vessels act 1917- Marine Insurance act 1963- The carriage goods of sea act 1925- Indian Railways act 1890- The carriers act 1865- Indian Post Office act 1898- The carriage air act 1993- Consumer protection act 1986- Indian information technology act 2000 (purposes and salient features of these acts only)

Unit – II: The Economic environment – National income – 5 year plans, Recession Fiscal policy – Value Added Tax (VAT), Information Technology, Telecommunication Technology, World Economic forum – Agricultural sector – Natural resources.

Unit– III: Political Environment, Pollution-age profile, Income and savings, education, health, Employment spending and saving patterns, Readership, ethos and culture

Unit – IV: Life table – Features – source of information – construction, interpretation, human mortality, Life table function, Non-integer ages uniform distribution of deaths.

Unit – V: Constant force of mortality, Mortality, characteristics, shape of q_x, l_x, and dx. Evaluation of means and variance with and without life table.

Books for study:
1. IC-12   Insurance Business Environment, By S.Balachandran Insurance Institute of India
2. CT-5 General Insurance, Life and health contingencies, Institute of Actuaries of India.

SEMESTER-VI   CORE PAPER-XI

SUBJECT TITLE: STATISTICAL INFERENCE-II

Subject description: This courses introduces the concepts of hypothesis testing

Goal: To enable the students to give inference on statistical population   based on sample statistics

Objective: On completion of the course the students should have gained knowledge on the methods of testing the hypothesis on different distributions and also the nature of statistics to which such test procedure can be used

Unit-I: Testing of Statistical hypothesis: Statistical hypothesis -simple and composite hypothesis, null and alternative hypotheses-sample and parameter space –two types of errors – critical region-power a test –Neyman- Pearson Lemma –simple applications

Unit-II: Most powerful tests-uniformly most powerful and unbiased tests based on Normal, t, and χ^2 and F distributions (with out proof)-likelihood ratio criterion –definition and simple applications

Unit –III: Test of significance –Asymptotic and exact tests based on Normal, t, and χ^2 and F distributions with regard to mean, proportion, variance, Standard deviation, coefficient of correlation, regression coefficients, partial and multiple correlation coefficients-Concept of observed significance level.

Unit-IV: Contingency table –Test for independence by contingency tables –goodness of fitness tests –tests of homogeneity of variances, correlation and proportions .Test of Normality (application only).

UNIT-V: Elementary ideas on distribution –free and non-parametric tests –Run, Median, Sign and Mann Whitney tests (without proof)-Equality of two distributions.

Books for study
1. Introduction to Mathematical statistics by Hogg, R.V and Craig, AG (amrend)
2. Introduction to Mathematical statistics by Hoel, P.G (Wiley International)
3. Statistical Methods by Snedecor, G.W and Cochran W. G (oxford and IBH)
4. Introduction to Mathematical Statistics by Brunk .H.D (Gann Co)
5. Practical Non-parametric Statistics by Conover (wiley International)
6. Fundamentals of Mathematical statistics by Guptha S.C and Kapoor V.K(Sulthan chand &sons)

SEMESTER VI   **Core Paper XII**
Course title: STATISTCIAL QUALITY CONTROL

Subject description: This course introduces the application of statistical tools on industrial environment to study, analyze and control the quality of products

Goal: To enable the students to know the concepts of process control and product control

Objective: on successful completion of the course the students should have understood various tools used such as control charts, sampling plans, quality system standards and reliability concepts to control the quality of industrial outputs.

Unit – I: Need for SQC – Role of frequency distribution – Statistical basis for SQC – variable control charts – $\bar{X}$, R and σ charts.

Unit II: Control Chart for attributes – np, p, c and u chart – Group control chart, OC and ARL of control charts, CUSUM charts using V- mark and decision intervals (concepts only)

Unit III: Acceptance sampling for Attributes – Single sampling plan – Double sampling plan – OC, AOQ, ASN and ATI curves – sequential sampling plan and their properties.

Unit IV: Quality system standards – ISO 9000- Elements of ISO – 9000 – Benefits of ISO 9000- Elements of a quality system – Documentation ISO 9000 accreditation

Unit V: Reliability concepts and measures, components and systems, reliability function, hazard rate, common life distribution viz, exponential, gamma and weibull.
Books for study:
1. Fundamentals of Applied statistics by Gupta S.C and Kapoor, V.K –
2. Quality control and Industrial Management   by Dunkan A.J.(Richard D.Irwin Inc.USA)
3. Statistical Quality Control by R.S. Leaven worth (Mc Graw Hill)
4 Statistics of Quality control, Sampling Inspection and Reliability by Biswas S (1996)(New Age Intl)
5. Statistical Analysis of Reliability and Life Testing Models, by Bain, L.J and Englehard, M. (1991) (Maral Dekker)

SEMESTER-VI   CORE PRACTICAL III
(USING STATISTICAL SOFTWARE PACKAGE)

Unit I:
    Essential terminology for all SPSS users-getting to SPSS for windows - the components of window - SPSS for windows screens – crucial preliminaries-entering data into SPSS-editing data-saving data file-retrieving data file.

Unit II:
   Merging data files –adding scores to existing cases –add variables – running a simple analysis and obtaining the output.

Unit-III
   Checking the data –Box plots of score distributions –listing of the data using case summaries –graphs –bar, line, pie chart, scatter plots and histograms.

Unit IV
   Frequency distribution-measures of frequency distributions-cross tabulations – obtaining two sample chi-square tests-log linear analysis –parametric statistical tests –comparing means-paired and unpaired t-tests

Unit V
   Correlation and multiple regession-analysing nominal and ordinal data-non parametric analysis-   Wilcoxon, mann-whitney, Kruskal Wallis tests –ANOVA: one way

Books for study and reference
Clifford E.Lunneborg (2000). Data analysis by resampling: concepts and applications .Dusbury Thompson learning .Australia.
Everrit ,B.S and Dunn,G(2001).applied multivariate data analysis . Amol London.
Jeremy J.foster(2001).data analysis using spss for windows. New edition. Versions 8_10.sage publications .London
Michael S Louis-Beck (1995).Data analysis an introduction,series:quantitave applications in the social sciences .Sage publications. London.

Three questions are to be answered out of **five** questions

For problems:	80	marks
For record :	20	marks
Total :	100	marks

SEMESTER-VI
CORE PRACTICAL PAPER-IV   (USING CALCULATOR)

Problems:
UNIT-I
Statistical inference-1:
 1. Estimation of parameters of the distribution by the methods of moments and maximum likelihood with regard to discrete and continuous distributions
 2. Confidence intervals based on Normal,χ^2,t and F distributions
 3. Determination of partial and multiple correlation coefficients-Multiple linear regression line and linear prediction involving three variables when the sums of squares and products are given.

UNIT-II
Basic sampling theory:
1. Estimation of mean and variance of the population and the variance of the estimator of the mean using Simple random procedure.
2. Stratified random sampling –Estimation of mean and variance of the population and of the variance of the estimator of the mean under proportional and optimum allocation.
3. Systematic sampling.

UNIT-III
Design of experiments:
1. Analysis RBD and LSD lay outs
2. Missing plot techniques in RBD and LSD
3. Analysis of $2^2, 2^3$ and 3^2 factorial designs with and without confounding.
4. Analysis of covariance with one concomitant variable to RBD.

UNIT-IV:
Statistical inference-II:
1. Standard Normal and exact tests of significance with regard to mean, variance, proportion, correlation and regression coefficients and partial multiple correlation coefficients
2. Test for homogeneity several variances-Bartlett test
Statistical quality control:
1. Control chat for attributes and variables**:** $\overline{X}$, R, p, np and c charts
2. Single sampling plan for attributes: OC, ATI, AOQ curves.
3. Single sampling plan for variables: OC curves: known and unknown standard deviation.
 Three questions to be answered out of five questions.
One question to be asked from each unit.

For problems:	80	marks
For record :	20	marks
Total :	100	marks

**SEMESTER -VI
DIPLOMA PAPER IV
(FOR THE B.SC STATISTICS STUDENTS ADMITTED DURING 2007-08 AND ONWARDS)**

SUBJECT TITLE: ACTUARIAL STATISTICS – IV
Course number: **Number of credit hours: 3(Three)**

Subject description: This paper introduces various types of risk and concepts relating to retirement benefits.
Goal: To enable the students to know the basic features of various insurance instruments.
Objective: On completion of the course the students should have gained knowledge in basic principles of insurance.

Unit–I: Concept of Risk – Peril and hazard – Different types of risks – classifications of risks – risk management – self insurance – advantages – IFRIMA

Unit–II: Classification of Insurance Business: Fire insurance – Marine insurance Motor Insurance- theft insurance – Health insurance – Engineering, Glass, liabilities – indemnity – Credit Insurances – Fidelity, Legal expenses, live stock insurances – Insurance Agent, broker, Consultant, Representative, Surveyor.

Unit–III: Basic Principles – Valid Contract – Utmost good faith – Duty renewal – Nomination – Assignment – Insurance Interest – Property Insurance – Features of Insurance Interest – Possession – Indemnity.

Unit–IV: Multiple decrement table – Dependent and independent rates – Obtaining dependent rates from independent rates – Independent rates form dependent rates.

Unit–V: Pension benefit and concentration – Accrued benefit – Age retirement benefit – future service benefit – ill–health retirement benefit – Death in service benefit.

Books for study:
1. IC-01 Principles of insurance By P.J Majmudar and M.G Diwan, Insurance Institute of India.
2. CT-5 General Insurance, Life and health contingencies, Institute of Actuaries of India.

SEMESTER V   ELECTIVE I - A
OPERATIONS RESEARCH – I

Subject description: This course introduces the concepts, models and problem solving techniques of optimization problems

Goal: To enable the students gain knowledge about various optimization techniques

Objective: After completion of the course the students will be able solve problems related to business and industry using linear programming techniques, Transportation and Assignment models.

Unit I : Origin, Meaning and Scope of operations Research –operations research model building, their types and the outline of the methods of solution.
Unit II: Linear programming: optimization problem - programming problem – solution by graphical method, simplex method – slack , surplus and artificial variables - Improving a basic feasible solution- optimality conditions.
Unit III: Degeneracy (Concept only) and breaking ties – Charne's Big M – technique-conversion of a minimization problem to a maximization problem.

Unit IV : Transportation problems :Introduction – the simplex method and transportation problems – obtaining an initial and feasible solution – by North – West corner rule – Vogel's method – Least cost entry method – MODI method for optimality. Degeneracy (concept only).
Unit V : Assignment problem: The assignment problem as a special case of the transportation problem – traveling sales man problem.
Books recommended
1. Linear programming methods and applications   by Gass SI (MC Graw Hill)
2. Linear programming by Loomba : (Tata MC Graw Hill)
3. Fundamentals of operations Research by Ackoff , R.I And Sasieni, MW : (Wiley International)
4. Operations Research – Methods and problems by Sasieni, Yaspen and Friedman (wiley International)
5. Operations Research by Kanti Swarup , Gupta PK and Manmohan (Sultan Chand and Sons)
   (Theory 50% and problems 50% be asked in the question paper)

ELECTIVE I - B: MATHEMATICAL ECONOMICS–I

Subject Description: This paper introduces the concepts of Economics and
                    Mathematics for the students of Statistics

Goal   : To enable the students to learn the application of
                         Mathematical tools in Economics

Objective   : On successful completion of this course the students gain
                        knowledge in the application of Mathematical models in
                        Micro Economics.

UNIT 1   :   Introduction – Nature of Economics – Economic Laws – scope of mathematical methods in Economics – Functions and Diagrams in Economic theories. Consumption – Wants and their nature – concept of utility – Marginal concept – Law of diminishing marginal utility – utility function and curve.

UNIT II   :   Scale of preferences – indifference curve and their properties – indifference map – utility index – price effect, income effect and substitution effect with respect to indifference curve analysis – Giffen's Paradox.

UNIT III   :   Price determination – concept of equilibrium – stability of price and quantity – price fixation under perfect competition – Monopoly – Duopoly – concept of Oligopoly.

UNIT IV   :   Cost function and curve – Average, Marginal and overhead costs – short term and long term costs – normal cost conditions – cost elasticity – comparison of market value and normal value.

UNIT V   :   Production function – factors of production. Law of Returns – Returns to scale – constant product curves – Marginal productivity law – Marginal rate of substitution – elasticity of productivity – Cobb-Douglass production function and its properties – producer's surplus – Economic application of integration.

Books Recommended :

1. Allen, RGD	:	Mathematical Analysis for Economists (Macmillan, 1962)
2. Chiang AC	:	Fundamental Analysis for Economics (Mc Graw Hill, 1962)
3. Metha and Madnani	:	Mathematics for Economists (Sultan Chand & Sons
4. Koores EF	:	Elements of Mathematical Economics (Houghton Migfia Co. 1965)
5. Stonier and Hague	:	Text book of Economic Theory
6. Dewett, KK	:	Modern Economic Theory
7. Jathar and Beri	:	Elementary Principles of Economics (Oxford University Press 10th Ed.) 1969.

ELECTIVE 1 - C: COBOL PROGRAMMING

Subject Description: This paper introduces the concepts of programming
                                    through COBOL language

Goal   : To enable the students to learn applications of business oriented
                                    problems using data structure.

Objective   : on successful completion of this course the students shall
                                enrich knowledge in COBOL programming and processing
                                sequential data

UNIT – I (SECTION 3 AND 4)
Introduction to COBOL – Coding format for COBOL Program- Structure of a COBOL Program – character set – COBOL word Data Name and Identifiers – Literals – Figurative constant continuation of Lines – Language Description Notations – Identification Division – Environment Division.

Unit – II (SECTION 5 AND 6)
Introduction to Data Division – Level structure – Data description entries – Editing – Classes and Categories of Data File section – Working Storage section – structure of the Procedure Division – Data movement verb – categories of COBOL Statements.

UNIT –III (SECTION 8 and 9)
Usage Clause – Synchronized Clause – Justified Clause Redefines Clause – Renames Clause – Qualification of Data Name SIGN Clause – Elementary and Group moves – Corresponding Option Rounded Option – On Size Error Option – Compute Verb.

UNIT – IV (SECTION 10 AND 11)
Condition – If Statement – Goto with Depending phrase – Perform Statement – Exit Statement – Table Handling – Occurs Clause and subscription – Assigning values Table Elements – Multidimensional Tables – Perform Verb and Table Handling.

UNIT –V (SECTION 13)
Sequential files – File characteristics – File control Entries – File Description – Statements for sequential files Sequential file with variable length Records – Application Programs Payroll Processing Mark sheet Preparation, Electricity Bill Preparation.

Books Recommended
1. M.K. Roy & D. Ghosh Dastidar, COBOL Programming, Tata Mc
Graw Hill, New Delhi, 1998

ELECTIVE II - A
ELEMENTS OF ECONOMETRICS

Subject description: This course introduces the application of statistical methods to economic
                        phenomena.
Goal: To enable the students to establish and verify economic relationships

Objective: On successful completion of the course the students should have understood
            econometric Model, estimation and testing of parameters, forecasting and verification
            of economic theory and application of models in planning.

Unit I: Definition-Scope-objectives of Ecnometrics-Limitations-Divisons of Econometrics.

Unit II: Single equation model two variable case-Reasons for introducing error term in the model-least square method of estimation and testing of parameters of the model-Estimation of error variance –Simple problems.

Unit III: General linear model-Assumptions –Least square method of estimation and testing of the parameters of the models –problems under failure of assumptions.

Unit IV: Multicollinearity- Effects of multicollinearity – detecting multicollinearity – Remedies –Autocorrelation-sources of autocorrelation- Dubin-watson test-Dummy variables (concept only)-Specification errors.

Unit V: Econometric models in planning: Mahalanobis four sector model-criticism of the model-problems-problems relating to three variable linear model and test for auto correlation.

Books for study:

1.Ecnometrics Basic and applied by Aaron C Johnson Jr,Marvin B Johnson and Rueben C Buse (Maxwell Maxmillan Intl editions)

2. Ecnometric methods by Johnston. J (McGraw Hill Intl students' editions)

3. Theory of Ecnometrics by Koutsoyannis. A (Palgrave publications Ltd)
4.Ecnometrics and mathematical Economics   by S.P Singh ,Anil K.Parashar and H P Singh (S.Chand & Co.)

ELETIVE II - B: INDIAN OFFICIAL STATISTICS

Subject Description: This paper gives an idea about various methods in which
                      Statistics are being collected in different sectors
Goal   :   To enable the students to understand how the statistics are
                       collected, recorded and published
Objective   :   On successful completion of this topic a student will have a
                       knowledge about the statistical organizations, NSSO etc
                       and the methods of collecting and recording statistics in
                       different sectors such as agriculture, industry etc.

UNIT 1   :   Statistical organization – Population Statistics – Agricultural Statistics – Indices
                 of Agricultural production – Miscellaneous Agricultural Statistics.

UNIT II   :   Industrial statistics – ASI – Indices of Industrial Production and profits.

UNIT III   :   Price statistics – Price index numbers – Labour Bureau; Index number of Retail
                 prices – Indices of security prices.

UNIT IV   :   Wage statistics – trade statistics – Financial statistics – National income
                statistics.

UNIT V   :   National sample surveys – Activities and publications of CSO and the
                Department of Statistics, Government of Tamil Nadu. National Income
                compilation.

Books Recommended:
1. Gupta SP   :   Statistical Methods (Sultan Chand & Sons)
2. Saluja MR   :   Indian Official Statistical System (Publication of Indian
                                  Econometric Society)
3. Central Statistical Organisation, Guide to Official Statistics 1979 Ed Department of Statistics,
    Ministry of Planning, India

ELETIVE II - C: GENITCAL STATISTICS

Subject Description   :   This paper introduces the concepts of genetics and
                            application of various statistical tools in genetics.

Goal   :   To enable the students to understand how to plan the
                       experiments Statistically and apply Statistical methods.

Objective   : On successful completion of this course the students shall enrich
                 knowledge in genetics and have job opportunities.

UNIT I   :   Elements of Genetics: Physical basis of heredity-cell structure
                      chromosomes and genes – Interaction of genes concept of genotypes and
                      phenotypes –Linkage and crossing over-Genetic maps.

UNIT II   :   Mandel's Law of inheritance –Laws of segregation and independent
                      assortment –concept over generation.

UNIT III   :   Use of $\chi 2$ (chi-square) tests in testing the Mendel's segregation law-Sex
                      linked genes –Concept of gene frequency –concept of random mating
                      detection and estimation of linkage from back cross, F_2,& F_3 data

UNIT IV   :   Method of maximum likelihood and other methods of estimation-
                      Planning of experiments.

UNIT V   :   Multiple allelic systems-Elementary aspects of the study of human blood
                      group.

Books Recommended:
1. Sinet Dunn and   :   Principles of Genetics
   Dot Zansky
2. Mather and Jinks   :   Biometrical Genetics
3. Mather K   :   Measurement of Linkage in Heredity
4. Kempthorne C   :   Introduction to Genetic Statistics (John Wiley)
5. Falconer   :   Quantitative Genetics.

EELECTIVE III - A   OPERATIONS RESEARCH – II

Subject description: This course introduces the concepts, models and problem solving
techniques
                        of optimization problems
Goal: To enable the students gain knowledge about various optimization techniques
Objective: After completion of the course the students will be able solve problems related to
             business and industry using Network analysis, Sequencing, Replacement problems,
             Game theory ,Decision anlaysis…

Unit 1: Network analysis: Introduction – Network construction – Critical path method (CPM) –
Labelling method – Method based on time estimates – Earliest and latest times. Project
evaluation and Review techniques (PERT) – Algorithm for PERT - Difference between CPM
and PERT. - simple problems.

Unit II: Sequencing : Introduction – n jobs and two machines, n jobs and three machines, n jobs and m machines – idle times and total elapsed time calculations.

Unit III Replacement Problem: Replacement models and their solution: Replacement of items whose maintenance costs increase with time and the value of money remains same during the period – Replacement of items whose maintenance costs increase with time and the value of money also changes with time, Replacement of items that fail completely : individual and group replacement policy – simple problems .

Unit IV: Game Theory: Description of games - solving the rectangular, two person, zero sum games: Saddle point and dominance methods-Graphical methods for 2xn and nx2 game problems.

Unit V: Decision Analysis: Types of decision models – Alternative Decisions –States of Nature – Outcomes. Decision making under conflict and uncertainty-minimax and maximin criteria, The Huruwiez criterion, the Laplace criterion and the Minimax regret criterion- simple problems-The expected monetary value criterion (EMV) - Decision Tree analysis: concept and simple problems simulation – Monte Carlo method only.

BOOKS for study:
1. Linear programming methods and applications by Gaus SI (Me Graw Hill)
2.Linear programming   by Loomba (Tata Mc Graw Hill)
3. Fundamentals of operations Research by Ackoff,R.I. and Sasieni ,M.W   (Wiley International)
4.Operations Research – Methods problem by Sasieni,Yaspen and Friedman (wiley international)
5 Operations Research   by Kanti swarup , Gupta ,P.K and Manmohan (Sultan Chand and sons)

(Theory 50% and problems 50% be asked in the question paper)

ELETIVE III - B: MATHEMATICAL ECONOMICS-II

Subject Description: This course introduces the concepts of Economics for the
                             Students of Statistics
Goal   :   To enable the students to learn the application of Mathematical
                             tools in Economics
Objective   :   On successful completion of this course the students shall
                            enrich knowledge in the application of Mathematical models in
                            Macro Economics.

UNIT 1   :   National income – Methods of estimation – uses of National income estimates –
                         Computational difficulties in India.

UNIT II   :   Income distribution – Inequalities of income causes of inequalities and remedies
                         for reducing inequalities – Pareto's law and Pareto's distribution – Properties

and uses – Fitting Pareto's Curve – Lognormal distribution – Lorenz curve approach.

UNIT III   :   Economic models – uses of models in Economic Theories – Exogenous and Endogenous variables – Structure and model – stochastic and non-stochastic models – Linear, non–linear, static, dynamic, micro and macro models – simple illustrations

UNIT IV   :   Propensity to consume – models of multiplier and accelerator – Harrod – Domar growth models – Cobweb model.

UNIT V   :   Leontief's input output analysis – closed and open systems – Dynamic version of this model.

<u>Books Recommended :</u>
1. Chiang AC   :   Fundamental methods of mathematical Economics (McGraw Hill – 1967)
2. Allen RGD   :   Mathematical Analysis for Economists (Macmillan)
3. Beach EF   :   Economic Models – An Exposition (John Wiley – 1957)
4. Lange O   :   Introduction to Econometrics (Pergamon Press – 1959)
5. Klein LR   :   An Introduction to Econometrics (Prentice Hall – 1969)
6. Seth M L   :   Planning of India

ELETIVE   C: QUANTITATIVE TECHNIQUES FOR MANAGERIAL DECISIONS

Subject Description: This paper introduces various concepts and methods related
                   to financial accounting, analysis and forecasting

Goal   : To enable the students to learn various techniques for
                   quantitative decision making.

Objective   :   On successful completion of this course the students will
                    have the ability to handle financial data more scientifically.

UNIT I   :   Basic principles of accountancy and analysis of balance sheets

UNIT II   :   Tools of financial analysis-Flow of funds, analysis-Cost, Volume, Profit analysis

UNIT III   :   Analysis of operating and financial leverages.

UNIT IV   :   Approaches to financial forecasting.

UNIT V   :   Project analysis.

Books Recommended:

1. Kuchhal SC	:	Financial Management (Chaitanya Pub. House, 2nd ed. Allahabad, 1972)
2. Development Centre of the Organization for Co-operation and Development, Paris	:	Manual of Industrial Project Analysis in Developing countries.
3. Foreign and Common Wealth Office (London)	:	Project Appraisal: check Lists and Discounting Tables.