

**RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)
THANJAVUR-613005**

**PG DEPARTMENT OF STATISTICS
(2015 -2016 onwards)**

RAJAH SERFOJI GOVT COLLEGE (AUTONOMOUS), THANJAVUR-5

C.B.C.S GENERAL STRUCTURE OF M.Sc., STATISTICS

(Applicable to the Students admitted from the academic year **2015-16** onwards)

PART	CODE	COURSE	TITLE	HRS	MARKS		TOTAL	CREDIT
					IA	AE		
I SEMESTER								
III	RR1PST1	CC1	Measure and Probability Theory	6	25	75	100	5
III	RR1PST2	CC2	Distribution Theory	6	25	75	100	5
III	R1PST3	CC3	Sampling Theory	6	25	75	100	5
III	R1PSTP	CC4	Statistics Practical - I	6	40	60	100	5
III	R1PSTEL1	EC1	Real Analysis and Linear Algebra	6	25	75	100	4
TOTAL				30			500	24
II SEMESTER								
III	RR2PST4	CC5	Statistical Inference	6	25	75	100	5
III	RR2PST5	CC6	Multivariate Analysis	6	25	75	100	5
III	RR2PST6	CC7	Linear Models and Design of Experiments	6	25	75	100	5
III	RR2PSTP	CC8	Statistics Practical - II	6	40	60	100	5
III	RR2PSTEL2	EC2	Stochastic Processes	6	25	75	100	4
TOTAL				30			500	24
III SEMESTER								
III	RR3PST7	CC9	Operations Research	6	25	75	100	5
III	RR3PST8	CC10	Statistical Quality Control	6	25	75	100	5
III	RR3PST9	CC11	Actuarial Statistics	6	25	75	100	5
III	RR3PSTP	CC12	Statistics Practical - III	6	40	60	100	5
III	RR3PSTEL3	EC3	Computer Programming with C++	6	25	75	100	4
TOTAL				30			500	24
IV SEMESTER								
III	RR4PSTP	CC13	Statistics Practical - IV	6	40	60	100	5
III	RR4PSTPW	CC14	Project Work	12	25	75	100	5
III	RR4PSTEL4	EC4	Statistical Software Packages	6	25	75	100	4
III	RR4PSTEL5	EC5	Demography	6	25	75	100	4
TOTAL				30			400	18
GRAND TOTAL							1900	90

Course	No. of Papers	Credit
Core Courses	14 (Each of 5 Credits)	70
Elective Courses	5 (Each of 4 Credits)	20
Total	19	90

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR1PST1**

M.Sc., Statistics - Semester: I
 (For students admitted from 2015 onwards)
 CORE COURSE – 1 (CC1)

MEASURE AND PROBABILITY THEORY

Unit-1

Events; algebra of sets, Fields: - σ fields; Borel fields, Intersection and union of field's monotone fields and necessary properties- minimal monotone class.

Unit-2

Function, inverse function, measurable function, Borel function, induced - σ field, indicator functions, elementary function, concept of random variable, Borel function of a vector random variable, Limits of random variables, continuity property of probability space, Caratheodory extension theorem (statement only), induced probability space, probability as a measure.

Unit-3

Distribution function, Properties, Jordan decomposition theorem, distribution function of a random vector, Marginal and conditional distributions, correspondence theorem (statement only) empirical distribution function, Expectation properties - Cramer Rao - inequality, Holder's inequality, Cauchy Schwartz's inequality, Minkowski inequality, Jensen's inequality, Basic inequality.

Unit-4

Convergence of random variables. Types of convergences: Monotone convergence theorem, Dominated convergence theorem, Characteristic function, properties, some inequalities on characteristic functions, inversion theorem and simple problems.

Unit-5

Limit theorems, Law of large numbers, Weak law of large numbers, Bernoulli, Poisson and Khinchine's law of large numbers; Strong law of large numbers, Levy-Cramer theorem, Central limit theorem, De-Moivre-Laplace, Liapounov's, Lindberg-Levy theorems. Statement of Lindberg-Feller theorem.

Books for study and Reference:

B.R.Bhat. Modern probability theory: Units 1,2,3,4,5,6 (up to 6.55 only), 7 (up to 7.4 only)

Mark Fisz. Probability theory and mathematical statistics: Unit 6 (omitting 6.4,6.5,6.10,6.13,6.14,6.15)

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR1PST2**

M.Sc., Statistics - Semester: I
(For students admitted from 2015 onwards)
CORE COURSE – 2 (CC2)
DISTRIBUTION THEORY

Unit-1

Fitting of Binomial, Poisson and Normal Distributions – Compound distributions – Binomial and Poisson - Definitions of MGF – Cumulative Functions – Moments, Additive Property only.

Unit-2

Negative Binomial, geometric, Pascal, Polya, Hyper-Geometric and Multinomial Distributions - Definitions of MGF – Cumulative Functions – Moments, Additive Property only (on using MGF).

Unit-3

Discrete uniform, Power series, Laplace, Weibull, Logistic, and Cauchy distributions - Definitions of MGF – Cumulative Functions – Moments, Additive Property only (on using MGF)

Unit-4

Non-Central Sampling distributions, Non-central Chi-Square, t and F distributions and their properties, Distributions of quadratic form for i.i.d. standard normal variates.

Unit-5

Order Statistics, Distribution of Smallest and largest observations. Distribution of Range and Median. Distribution of r^{th} order statistic. Joint distribution of two order statistics. Joint distribution of several order statistics.

Books for Study and Reference:

Rohatgi, V.K. (1984) Introduction to Mathematical Statistics, Wiley Eastern.

Gupta, S.C. and Kapoor, V.K. (1977) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR1PST3**

M.Sc., Statistics - Semester: I
(For students admitted from 2015 onwards)
CORE COURSE – 3 (CC3)
SAMPLING THEORY

Unit-1

Simple random sampling with and without replacement. Simple random sampling for proportions- Properties of estimates of mean and variance - confidence limits- Estimation of sample size for proportions, Estimation of sample size.

Unit-2

Stratified random sampling - methods of allocation- Relative precision of stratified random sampling with simple random sampling- Estimation of gain in precision due to stratification – stratified sampling for proportions- Estimation of sample size.

Unit-3

Systematic random sampling- linear systematic sampling- Circular systematic sampling- Estimation of the variance- comparison of systematic sampling with SRS and stratified sampling- Concept of ratio and regression estimators.

Unit-4

Cluster sampling- Equal cluster sampling- Estimator of mean and its variance- relative efficiency of cluster sampling. Optimum cluster size- Multi-stage sampling - Two-stage sampling with equal first-stage units- Estimator of mean and its variance. Two-stage sampling with unequal first stage units- Estimators of mean and its variance.

Unit-5

Multistage sampling – Double sampling for stratification – Optimal allocation – Double sampling for difference estimator – Double sampling for ratio estimator – Double sampling for regression estimator.

Books for study and Reference:

Moorthy, M.N. (1967) Sampling Theory and Methods, Statistical Publishing Society, Calcutta.

Daroga Singh and F.S.Chowdry. Theory and Analysis of sampling survey design, New age international (p) ltd, Chennai.

Cochran, W.G. (1984) Sampling Techniques, Wiley Eastern Ltd.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
Hours / Week : 6
Medium of Instruction : English

Code : **RR1PSTP1**

M.Sc., Statistics - Semester: I

(For students admitted from 2015 onwards)

CORE COURSE – 4 (CC4)

STATISTICS PRACTICAL - I

Sampling Theory:

Sample size estimation – Simple Random Sampling, Stratified Random Sampling with Allocations, Systematics sampling, single stage cluster sampling (equal size) Two Stage cluster with equal probability.

Distribution Theory:

Probability Models - Binomial Distribution, Poisson Distribution, Normal Distribution, Negative Binomial Distribution, Geometric Distribution, Pascal Distribution, Polya Distribution, Hyper-Geometric Distribution, Mutinomial Distribution, Uniform Distribution, Power series Distribution, Laplace Distribution, Weibull Distribution, Logistic Distribution and Cauchy Distribution

Question Paper Pattern:

Maximum Marks: 60

Practical Exam duration: Three Hours

Pattern of Practical Question: $4 \times 15 = 60$ Marks

Internal: (Model Practical – 25 Marks + Observation note – 10 Marks + Record Note – 5 Marks = 40 Marks)

Signature of the HOD

COE

Credits : 4
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR1PSTEL1**

M.Sc., Statistics - Semester: I
 (For students admitted from 2015 onwards)
 ELECTIVE COURSE – 1 (EC1)

REAL ANALYSIS AND LINEAR ALGEBRA

Unit-1

Real valued function- sequence and series of functions, uniform convergence and its application (without proof)- real valued functions of several variables- limit, continuity and derivability of functions. Maxima and minima for functions of two or three variables.

Unit-2

Definition of the Riemann integral – Existence of the Riemann integral – Properties of the Riemann integral – Derivatives – Rolle's theorem

Unit-3

Rank of a matrix- Elementary transformation. Elementary matrices- Echelon matrix- Hermit's canonical form- Sylvester's law- Frobenius inequality- certain results on a rank of an idempotent matrix. Theory of linear equations,

Unit-4

Generalized inverse of a matrix- different classes- properties-properties of Moore and Penrose- Applications of generalized inverse in the solution of system of linear equations solution of linear equations. Least square properties of Moore and Penrose generalized inverse applications of M-P inverse for the solution of optimization problems.

Unit-5

Eigen values and Eigen vectors- spectral decomposition of a symmetric matrix- Cayley- Hamilton theorem. Quadratic forms and inequalities- classification- positive semi-definite- Gram matrix- Quadratic form into sum of squares- Lagrange's method.

Books for study and Reference:

Goldberg.R- Methods of Real Analysis

Biswas.S- Topics in Algebra in Matrices *Ch.4:1 to 9; Ch.5:full; Ch.6:1 to 9; Ch.7:1,4; Ch.8:1 to 5.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PST4**

M.Sc., Statistics - Semester: II
(For students admitted from 2015 onwards)
CORE COURSE – 5 (CC5)

STATISTICAL INFERENCE

Unit -1

Criteria for point estimation: Concept of highest concentration; and unbiasedness- correction for bias; Minimum variance unbiased estimators- MVB estimators – mean square error estimators; Cramer-Rao inequality; Bhattacharya bounds, Chapman – Robbins bounds, concept of efficiency and BAN estimators.

Unit -2

Sufficient and minimal sufficient statistics; complete statistics and boundedly complete statistics; definition and properties of Fisher's information measure Factorization theorem; condition for existence of sufficient statistics; loss and risk functions; convex loss function; minimax; Rao-Blackwell theorem. Determination of UMVU estimators, Lehman-Scheffe theorem.

Unit -3

Methods of estimation: methods of moments, minimum chi-square and its modification, detailed study of maximum likelihood estimator and its properties Least square estimators.

Unit -4

Interval estimation: Shortest confidence intervals; construction methods (using pivots, central limit theorem and Chebyshev's inequality); Simultaneous confidence intervals for several parameters, Neyman's shortest confidence intervals; confidence intervals for parameters of standard distributions.

Unit -5

Bayesian estimation: notions and prior and posterior distributions: improper and vague priors; conjugate priors; Baye's estimates and Baye's intervals; Baye's risk and Bayes estimator

Books for Study and Reference:

Rohatgai, V.K. (1985). An Introduction to Probability Theory and Mathematical Statistic, wiley eastern
Mood, A.M., F.A. Graybill and D.C Boes (1964), Introduction to the Theory Statistics, McGraw Hill, 3rd ed.

Zacks (1971). The Theory of Statistical Inference, John Wiley, New York.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PST5**

M.Sc., Statistics - Semester: II
(For students admitted from 2015 onwards)
CORE COURSE – 6 (CC6)

MULTIVARIATE ANALYSIS

Unit-1

Multivariate normal distribution and its applications- Marginal and conditional distributions- Maximum likelihood estimation of the mean vector and its covariance matrix, total, partial and multiple correlation coefficients and their distributions (only null case).

Unit-2

Hotelling T^2 statistic- Mahalanobis D^2 statistic their distributions and applications- testing the significance of mean vector and equality of mean vectors when the covariance matrices are: (i) known (ii) unknown.

Unit-3

Wishart distribution- definition, derivation and properties, generalized variance definition and distribution.

Unit-4

Discriminant analysis- Fisher's discriminant function-standards of good classification classification into one of two normal populations- Baye's procedure of misclassification probabilities.

Unit-5

Principal component analysis, definition- properties and extraction of the components- Canonical correlations and Canonical variables and their evaluation.

Books for study and Reference:

Anderson, T.W. (1983): An introduction to Multivariate analysis, (2nd Edn) John wiley.

Johnson, A.R. and Wichern, W.D. (1988) : An introduction to applied multivariate analysis, Prentice Hall, India

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PST6**

M.Sc., Statistics - Semester: II
 (For students admitted from 2015 onwards)
 CORE COURSE – 7 (CC7)

LINEAR MODELS AND DESIGN OF EXPERIMENTS

Unit-1

Linear models- least squares estimation- estimability of a linear parametric function. Best linear unbiased estimate (BLUE) for Gauss-Markoffs set up- Gauss- Markoffs Theorem. Tests of linear hypothesis and its applications to analysis of variance RBD with many observations per cell- its analysis- LSD – and its analysis- missing and mixed up plot technique- one and two observations missing in RBD and LSD- Analysis of non-orthogonal data.

Unit-2

Factorial experiment- Effects and interactions in 2^n , $3^2, 3^3$ experiments. Total and partial confounding. System of confounding for 2^n experiments Analysis of Split Plot design. Fractional factorial for 2^n series only.

Unit-3

Balanced incomplete block design (BIBD). Concept of connectedness and balancing- Intra block analysis of BIBD. Recovery of inter block information.

Unit-4

Partially Balanced Incomplete Block Design (PBIBD) of two associates classes. Parametric relations and intra block analysis of PBIBD(2). Youden Square Design and its analysis.

Unit-5

Design of Response surface- Linear and second order response surface designs. Concept of Lattice, weighing, Balanced and Partially Balanced designs.

Books for study and Reference:

Graybill, F.A. An introduction to Linear Statistical Models, McGraw Hill, New York.

Joshi, D.D. Linear Estimations and Design of Experiments, Wiley Eastern Ltd, New Delhi.

Das, M.N. and Giri, N.C. Design and analysis of experiments, Wiley Eastern Ltd, New Delhi.

Aloke Day Theory of Block Design, Wiley Eastern Ltd, New Delhi.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PSTP2**

M.Sc., Statistics - Semester: II

(For students admitted from 2015 onwards)

CORE COURSE – 8 (CC8)

STATISTICS PRACTICAL - II

Statistical Inference:

Region and power curves concerning testing of hypothesis on the parameters of the following distributions when alternatives are one sided as well as two sided.

- Binomial Distribution
- Normal Distribution
- Exponential Distribution

Multivariate Analysis:

Hotelling's T^2 Statistic

(a) Testing for $\mu = \mu_0$

(b) Testing $\mu_1 = \mu_2$

Mahalanobis D^2 Statistics, Testing for equality of means, Discriminant functions, Principal component analysis.

Linear Models and Design of Experiments:

Linear Models and Estimation of BLUE – Analysis of Covariance – Greco Latin Square Design – Split plot and Strip plot techniques – 2^n and 3^n ($n \leq 3$) factorial experiments with and without total and partial confounding - BIBD – PBIBD - Youden Square Design – Lattice Design.

Question Paper Pattern:

Maximum Marks: 60

Practical Exam duration: Three Hours

Pattern of Practical Question: $4 \times 15 = 60$ Marks

Internal: (Model Practical – 25 Marks + Observation note – 10 Marks + Record Note – 5 Marks = 40 Marks)

Signature of the HOD

COE

Credits : 4
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PSTEL2**

M.Sc., Statistics - Semester: II
(For students admitted from 2015 onwards)
ELECTIVE COURSE – 2 (EC2)
STOCHASTIC PROCESSES

Unit-1

Introduction to Stochastic Process, Classification of Stochastic Process. Countable State Markov Chain. Chapman-Kolmogorov's Equations, Calculation of n-step Transition Probability and its limit. Stationary Distribution, Classification of States, Transient Markov chain, Random Walk and Gambler's Ruin Problem.

Unit-2

Continuous Time Markov Process: Kolmogorov Differential Equations, Poisson Process, Birth and Death Process, Applications to queues and Storage problems.

Unit-3

Discrete Parameter Stochastic Process/time series. Auto- Covariance and Auto-correlation and their properties.

Unit-4

Detailed study of the stationary process like (a) Moving Average, (b) Autoregressive, (c) Autoregressive moving average. (d) Autoregressive Integrated Moving Average, Box Jenkins Models, Brief discussion of Estimation and Related Large Sample theory of the mean.

Unit-5

Choice of AR and MA terms. Brief discussion of techniques of the ARIMA model parameters and forecasting. Study of Residuals and Diagnostic Checking.

Books for Study and Reference:

Karlin, S. and Taylor, H.M. (1975): A First Course in Stochastic Process, vol.I, Academic Press.

Medhi, J. (1982): Stochastic Process, Wiley Eastern.

Fuller, W.A. (1976): Introduction to Statistical Time Series, John Wiley, NY.

Granger, C.W.J. and Newbold, (1984): Forecasting Econometric Time Series, Third Edition, Academic.

Box, G.E.P., and Jenkins, G.M., (1976): Time series Analysis- Forecasting and Control. Holden-Day San Francisco.

Anderson, T.W., (1971): The Statistical Analysis of time Series, Wiley, NY.

Kendall, M.G., and Stuart, A. (1966): The advanced Theory of Statistics, Vol.3, Charles Griffin, London.

Adke, S.R. and Manjunath, S.A. (1984): An Introduction to Finite Markov Processes, Wiley Eastern.

Parzen, E. (1962): Stochastic Processes, Holland-Day.

Question Paper Pattern:

Maximum Marks: 75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR3PST7**

M.Sc., Statistics - Semester: III
(For students admitted from 2015 onwards)
CORE COURSE – 9 (CC9)
OPERATIONS RESEARCH

Unit -1

The General Linear Programming Problem (GLPP): Properties and Solutions of the LPP; Graphical Method, Theory and Computational Algorithm of Simplex Method, Duality Theorem.

Unit -2

Transportation problem; Balanced and Unbalanced problems; Mathematical Model of Transportation Problem; Methods for finding initial basic feasible solution; North-West Corner rule, Least cost method, Vogel's approximation method, Test for Optimality; Modi method. Assignment problem; Hungarian method.

Unit -3

Sequencing Problem with 'n' jobs and 2 machines, problems with 'n' jobs and 3 machines. Integer programming- Branch and Bound method, Dynamic programming – principles of optimality, recursive equation approach, characteristic of dynamic programming problem.

Unit -4

Game theory: Two person Zero sum games; Pure strategy; Mixed strategy ; Dominance; m x n games; Graphical solution. CPM; PERT; float and Slack; Advantages of Networks.

Unit -5

S-S policy for inventory, Inventory problems: definition, concepts of various costs - inventory models: EOQ model with constant rate of demand; EOQ model with different rates of demand; estimation of EOQ in some simple cases.

Books for Study and Reference:

Taha, H.A. (2007). Operation Research – An Introduction, 8th Edn. Prentice Hall of India Pvt. Ltd.

Sharma, S (2006). Introductory Operations Research, Discovery Publishing House.

Starr, M.K. and Miller D.W. Inventory Control Theory and Practice, Prentice Hall.

Wagner, H.M Principles of Operations Research with applications to managerial decision Prentice-Hall.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A **10 × 2 = 20** Answer **ALL** Questions (Two questions from each unit)

Part B **5 × 5 = 25** Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C **3 × 10 = 30** Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR3PST8**

M.Sc., Statistics - Semester: III
 (For students admitted from 2015 onwards)
 CORE COURSE – 10 (CC10)

STATISTICAL QUALITY CONTROL

Unit -1

Meaning scope of statistical quality control; causes of quality variation, statistical basis for control charts, choice of control limits, sample size and sampling frequency, rational subgroups, specification, tolerance and warning limits. Construction and operations of \bar{X} , R and σ charts, np, p, C and U charts, operating characteristic curve for control charts.

Unit -2

Principles and construction of modification control charts, cumulative sum control chart, basic principles and design of CUSUM charts, concept of V – mask, one and two sided decision procedures. Moving-average and geometric moving – average control chart, sloping control charts.

Unit -3

Acceptance sampling plans, Rectifying inspection, sampling inspection by attributes, concept of OC, ASN, ATI, AOQ functions of sampling plans AQL, LTPD, producer's risk and Consumer's risk on OC curve operation and use of single, double and multiple sampling plans. MIL STD – 105D standard, Dodge and Romig sampling plans.

Unit -4

Sampling inspection by variables – known and unknown sigma, variable sampling plan, merits and demerits of variable sampling plan, derivation of OC curve and the parameters of the plan. Continuous sampling plan by attributes, CSP – 1, CSP – 2 and CSP – 3 concept of AOQL in CSPs and multi-level continuous sampling plans, Indian standards ISO 2000(Concepts Only).

Unit -5

Concept of reliability, components and systems, coherent systems, reliability of coherent systems. Life distributions, reliability function, hazard rate, common life distribution, exponential, weibull, gamma distributions. Estimation of parameters, IFR and DFR distributions. Reliability of system with independent components, basic idea of maintainability.

Books for Study and Reference:

Montgomery, D.C (1985) Introduction to Statistical Control, John Wiley and Sons, New York.
Sinha, S.K (1979), Reliability and life-testing, Wiley Eastern, New Delhi.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR3PST9**

M.Sc., Statistics - Semester: III
(For students admitted from 2015 onwards)
CORE COURSE – 11 (CC11)
ACTUARIAL STATISTICS

Unit-1

Actuarial statistics –definition –Role of statistics in insurance companies and business organizations –utility function –concave function – concept of risk – Risk models for short term periods – Life tables.

Unit-2

Effective Rate of Interest – Nominal Rate of Interest – Force of Interest –Relationship between $i.i(m)$ and Present value – Effective and Nominal Rate of Discount.

Unit-3

Annuity – Types of annuity - Present values of Immediate Annuity, Annuity-due, Increasing and Decreasing Annuities.Continuous Annuity – Accumulation of Annuities – Present value and Accumulation of Annuities increasing by step and continuously.

Unit-4

Investment analysis –Time value of money – Methods of investment analysis: Traditional methods, Discounted cash flow methods with problems – investment under certainty (Risky investments) – certainty-equivalent method approach – Statistical distribution method – Expected value of NPV – Variance of NPV (with problems).

Unit-5

Simulation approach to risky investments - Break-Even analysis - Discounted Mean Term (DMT) – Volatility – Volatility of Fixed Interest Securities – DMT of Zero Coupon Bond – Variation of Volatility with respect of coupon.

Books for Study and Reference:

Shailaja D Deshmukh. Actuarial statistics – university press (India) pvt.Ltd. Hyderabad. (Units covered: 1,2,3&5)

Kanti Swarup, P.K. Gupta & Man Mohan: Operations Research – Sultan Chand & Sons (Units covered: 4& first two topics in 5)

ASI Study material for subject – 102, (Units covered: form third to end in 5)

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR3PSTP3**

M.Sc., Statistics - Semester: III

(For students admitted from 2015 onwards)

CORE COURSE – 12 (CC12)

STATISTICS PRACTICAL - III

Operations Research:

Transportation Model: North West Corner Rule, VAM, Methods – Problems of Excess demand / Supply – Assignment Model: Hungarian Method. Game Theory: (2x2, 2xn games) – Sequential model: Processing N jobs through two machines, Processing N Jobs through m Machines.

Statistical Quality Control:

Control Charts for \bar{X} Charts, R-Chart, np-Chart, U-Chart, d-chart, Acceptance sampling plan – Attributes (OC, AOQ, ASN : Single and Double sampling), Sequential sampling plans – Moving - average and moving average range charts, O.C. Curves for control charts.

Question Paper Pattern:

Maximum Marks: 60

Practical Exam duration: Three Hours

Pattern of Practical Question: $4 \times 15 = 60$ Marks

Internal: (Model Practical – 25 Marks + Observation note – 10 Marks + Record Note – 5 Marks = 40 Marks)

Signature of the HOD

COE

Credits : 4
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR3PSTEL3**

M.Sc., Statistics - Semester: III
(For students admitted from 2015 onwards)
ELECTIVE COURSE – 3 (EC3)

COMPUTER PROGRAMMING WITH C++

Unit-1

Principles of Object – Oriented Programming – Software Evolution Procedure and Object Oriented Paradigm – Basic concepts of Object – Oriented Programming – Benefits of OOP – Object Oriented Languages – Application of OOP - Beginning with C++ - What is C++?. - Application of C++ - C++ statements – Structure of C++ Program – Tokens , Expressions and Control Structures – Tokens – Identifiers – Basic and User – Defined Data Types – Operators in C++ - Operator Overloading – Operator precedence – Control Structures.

Unit-2

Functions in C++:- The Main Function – Function Prototyping – Call by Reference – Return by Reference – Inline functions – Function Overloading – Friend and Virtual Functions – Classes and Objects – Introduction – Specifying a Class – Defining Member function – Nesting of Member Function – Private member Functions – Arrays within a Class – Static Data Members- Static Member Function – Array of Objects – Objects as Function Arguments, Friendly Functions – Pointers to Members.

Unit-3

Constructors and Destructors:- Constructors – Copy Constructor Dynamic Constructor- Constructing Two – Dimensional Arrays – Destructors – Operators Overloading –Type Conversions.

Unit-4

Inheritance, Extending Classes:- Defining Derived classes – Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance – Virtual Base Classes – Abstract Classes-Pointers, Virtual Functions and Polymorphism – Pointers to Derived Classes – Virtual Functions.

Unit-5

Managing Console I/O Operations:-C++ streams – C++ stream Classes – Unformatted I/O Operations - Formatted Console I/O Operations – Managing output with Manipulators- Working with Files:- Classes for File Stream Operations- Opening and Closing a File – File Pointers and their manipulators – sequential I/O Operations. Simple Statistical Problems.

Books for Study and Reference:

E.Balagurusamy (1998) : Object Oriented Programming with C++. Tata McGraw Hill Publishing Company Limited.

K.R.Venugopal, Rajkumar, T.Ravi shankar (1998): Mastering C++, Tai.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A **10 × 2 = 20** Answer **ALL** Questions (Two questions from each unit)

Part B **5 × 5 = 25** Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C **3 × 10 = 30** Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
Hours / Week : 6
Medium of Instruction : English

Code : **RR4PSTP4**

M.Sc., Statistics - Semester: IV

(For students admitted from 2015 onwards)

CORE COURSE – 13 (CC13)

STATISTICS PRACTICAL – IV

MEASUREMENT OF FERTILITY:

Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR)

MEASUREMENTS OF MORTALITY:

Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality Rate (IMR) and Standardized Death Rate (SDR - Direct and Indirect Methods)

LIFE TABLE:

Computational of Life Table: L_x , l_x , e^x , d_x , etc...

Question Paper Pattern:

Maximum Marks: 60

Practical Exam duration: Three Hours

Pattern of Practical Question: $4 \times 15 = 60$ Marks

Internal: (Model Practical – 25 Marks + Observation note – 10 Marks + Record Note – 5 Marks = 40 Marks)

Signature of the HOD

COE

Credits : 5
Hours / Week : 12
Medium of Instruction : English

Code : **RR4PSTPW**

M.Sc., Statistics - Semester: IV

(For students admitted from 2015 onwards)

CORE COURSE – 14 (CC14)

PROJECT WORK

Dissertation 75 Marks

Viva voce 25 Marks

Signature of the HOD

COE

Credits : 4
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR4PSTEL4**

M.Sc., Statistics - Semester: IV
(For students admitted from 2015 onwards)
ELECTIVE COURSE – 4 (EC4)

STATISTICAL SOFTWARE PACKAGES

Unit-1

Introduction to Excel – Various Distributions - Descriptive Statistics - Data analysis tools – ANOVA – Covariance - Regression – Correlation – Non parametric tests — Time series analysis - Using Macros

Unit-2

Introduction to SPSS 10.0 Icons - Opening files - File extension - Working with Data - Summarizing Data and Printing - Hypothesis Testing - Descriptive statistics for qualitative and quantitative data – Graphs and Charts.

Unit-3

Regression and Correlation Analysis – Simple Correlation – scatter diagram, Simple Regression – scatter diagram, Simple Regression – Estimation and Interpretation of results, Multiple Regression Scatter plot Matrix – Multiple Regression.

Unit-4

Estimation and Testing of Hypothesis - Time Series Analysis and Forecasting – Linear Trend – Non – Linear Trend – Seasonality –Forecasting with Linear Trend and regression Models - Index Numbers.

Unit-5

Introduction to MINITAB 14.2 – Preliminary data analysis – Descriptive statistics – Probability theory – Inferential Statistics for single through multiple samples.

Websites:

www.spss.com\Help, www.stata.com, www.spss.org
 Help manuals of SPSS version 10 Manual of MINITAB

Books for Study and Reference:

SPSS for Windows Step by Step: A simple Guide and Reference, 10.0 update (3rd edition) by **Darren George and Paul Mallery**

An Introductory Guide to SPSS for Windows by **Eric L. Einpruch**

Borovikov, I.P. and Borovikov, V.P. STATISTICA: Data Preparation and Analysis. Moscow: Filini, (1998)

Borovikov, V.P. A Quick Introduction to STATISTICA. Moscow: Computer, (1998)

The Complete Idiot's Guide to Microsoft Excel (2000) By **Sherry Kinkoph**

How to Do Everything with Microsoft Office Excel (2003) By **Guy Hart – Davis**

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A **10 × 2 = 20** Answer **ALL** Questions (Two questions from each unit)

Part B **5 × 5 = 25** Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C **3 × 10 = 30** Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 4
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR4PSTEL5**

M.Sc., Statistics - Semester: IV
(For students admitted from 2015 onwards)
ELECTIVE COURSE – 5 (EC5)
DEMOGRAPHY

Unit-1

Census: Essential features information available from Indian census. Registration : Vital statistics system, deficiencies. Sample Survey: Major Demographic surveys.

Unit-2

Definition : crude and age specific marriage, divorce and widowhood rate, singulate mean age marriage. Definition : Computation of crude birth rate, general fertility rate, age specific fertility rate, total fertility rate, gross reproduction rate.

Unit-3

Definition computation of crude death rate, age-specific death rate, infant mortality rate, perinatal mortality rate, neo – natal mortality and post neonatal mortality rate. Direct and indirect standardization , construction of life tables and their uses.

Unit-4

Net reproduction rate, stable population intrinsic birth rate ,death rate and growth rate, stable age distribution mean length of generation.

Unit-5

Population Estimation: Component method, use of national sample surveys and registrations, cohort – component method, mathematical methods, forward – reverse survival procedure. Projection of total population and age sex composition: mathematical methods, component methods, age sex diargrated methods.

Books for Study and Reference:

Shyrock,H.S., Siegal, J.S. et. al(1976) : Studies in population , The Methods and Materials of Demography, Academic Press.

Keyfitz, Nathan(1977) : Introduction to the Mathematics of population, Addison – Wesley Publishing Company, Reading Massachusetts.

Offices of Registrar General, Indis (1988) : Hand Book of Civil Registrations, Ministry of Home Affairs, Govt. of India, NewDelhi.

Bhende, A and T.Kanitkar (1988) : Principles of population studies , Himalaya publications, Bombay

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

List of Non Major Courses Papers:

- 1. STATISTICAL TECHNIQUES FOR ECONOMIC ANALYSIS**
- 2. STATISTICAL TECHNIQUES FOR DECISION MAKING**

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PEC8**

Semester: II
(For students admitted from 2015 onwards)

I - PAPER

STATISTICAL TECHNIQUES FOR ECONOMIC ANALYSIS
(M.A., ECONOMICS)

Unit 1:

Correlation – types – Methods: Karl Pearson’s and Spearman’s rank Correlation Coefficients – Regression analysis – Least Square method (Simple problems)

Unit 2:

Probability – Events and sets – Addition and Multiplication rules – Random variables and Probability distribution – Binomial, Poisson and Normal – distributions (Concept and properties only)

Unit 3:

Random sampling – Simple, Stratified, Systematic and Cluster sampling – Sampling distribution of sample statistic – Chi-square, Student’s “t” and F distributions (Concept and properties only)

Unit 4:

Large sample tests – Test for single proportion and test for difference between Proportions. Test for single mean with known variance and unknown variance – Test for difference between two means with known and unknown variance.

Unit 5:

Small sample test – Definition – ‘t’ test concerning means - Difference between means Chi-square test of goodness of fit and independence of attributes. (Simple problems)

List of books for study / Reference

1. Gupta S.P. – Statistical Methods.
2. Statistics: Theory and practice by R.S.N. Pillai & Bhagawathi

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A **10 × 2 = 20** Answer **ALL** Questions (Two questions from each unit)Part B **5 × 5 = 25** Answer **ALL** Questions (Either or type-Two questions from each unit)Part C **3 × 10 = 30** Answer Any **THREE** Questions (One question from each unit)

Signature of the HOD

COE

Credits : 5
 Hours / Week : 6
 Medium of Instruction : English

Code : **RR2PCO6****Semester: II****(For students admitted from 2015 onwards)****I - PAPER****STATISTICAL TECHNIQUES FOR DECISION MAKING****(M.Com., - COMMERCE)****Unit 1:**

Correlation concept – Methods, Scatter diagram, Karl Pearson’s correlation, Spearman’s Rank correlation and Regression analysis.

Unit 2:

Probability – Events, Sets – Addition and Multiplication rules – Binomial, Poisson, Normal, Chi-square, “t”, “F” concept and properties only (without proof). Test of hypothesis, concerning means, proportions, difference between means (Simple problems).

Unit 3:

Random sampling – Simple, Stratified, Systematic and Cluster sampling – Sampling distribution of sample statistic – Chi-square, Student’s “t” and F distributions (Concept and properties only)

Unit 4:

Analysis of time series– Definition and uses. Components – Measuring trend, seasonal variations, Fitting a straight line by the method of least square and moving averages (Simple problems).

Unit 5:

Index Numbers – Definition and uses. Weighted and Unweighted – Price index numbers – types. Test in index numbers – Time and Factor reversal test. Cost of living index number (Simple problems).

List of books for study / Reference

S.P.Gupta – Statistical Methods.

Question Paper Pattern:

Maximum Marks:75

Exam duration: Three Hours

Part A $10 \times 2 = 20$ Answer **ALL** Questions (Two questions from each unit)

Part B $5 \times 5 = 25$ Answer **ALL** Questions (Either or type-Two questions from each unit)

Part C $3 \times 10 = 30$ Answer Any **THREE** Questions (One question from each unit)

COE**Signature of the HOD**