# RAJAH SERFOJI GOVT. COLLEGE

**(AUTONOMOUS AND NAAC "A" GRADE)**

**THANJAVUR-613005**

# PG DEPARTMENT OF STATISTICS
# (2018 -2019 onwards)



# PG PROGRAMME: M.STATISTICS
# CBCS- COURSE PATTERN (2018-2019)
# SEMESTER WISE DISTRIBUTION OF
# PAPAERS (COURSES)

# Semester I
# M.Statistics    Code: S1PST1
(For students admitted from 2018 onwards)
## CC 1 - MEASURE AND PROBABILITY THEORY

Credits     : 5
Hours / Week : 6

**Learning objectives:** To impart knowledge in the measure and probability theory. To illustrate probabilistic pre-requisites which are required for building statistical models.

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

**Unit- II** 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, induced probability space, probability as a measure.

**Unit- III** 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, Jenson's inequality, Basic inequality.

**Unit- IV** 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- V** 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.

**Learning outcomes:** To learn how to analysis the measure and measurable functions, definition of random variable, distribution function and concepts of convergence of distribution. Important theorems like CLT are discussed in this paper.

**Text Books and Reference**
**B.R.Bhat**. Modern probability theory, New Age International Publishers- Third Edition (Chapters : 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)
<u>Question Paper Pattern</u>

Maximum Marks:75     Exam duration: Three Hours

Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                          **COE**

(For students admitted from 2018 onwards)
## CC 2 - ADVANCED DISTRIBUTION THEORY

Credits        : 5
Hours / Week : 6

**Learning objective:** To learn basic and advanced techniques in distributions and their properties, characteristics.

**Unit- I:** Binomial, Poisson and Normal Distributions –- Definitions, properties, moments and its applications – Compound distributions.

**Unit-II:** Negative Binomial, geometric, Pascal, Polya, Hyper-Geometric and Multinomial Distributions – Definitions, properties, moments and its applications.

**UnitIII:** Discrete uniform, Power series, Laplace, Weibull, Logistic, and Cauchy distributions - Definitions properties, moments and its applications.

**UnitV:** Concept of 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-V:** 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.

**Learning outcomes:** The aim of this paper is to teach distribution theory to the students of Statistics so that the students may learn the subject and also make use of the same on practical side.

## Text Books 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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                            **COE**

## Semester I
## M.Statistics                 Code: S1PST3
(For students admitted from 2018 onwards)
## CC 3 - ADVANCED SAMPLING THEORY

Credits         : 5
Hours / Week : 6

**Learning objectives:** To develop an understanding about different sampling methods. Discuss the relative advantages & disadvantages of each sampling methods.

**Unit I:** 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 II:** 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 III:** 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 IV:** 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 V:** Multistage sampling – Double sampling for stratification – Optimal allocation – Double sampling for difference estimator – Double sampling for ratio estimator – Double sampling for regression estimator.

**Learning outcomes:** To obtain the optimum results, i.e., the maximum information about the characteristics of the population with the available sources at our disposal in terms of time, money and manpower by studying the sample values only.

### Text Books 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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)


**HOD**                                                                                              **COE**

# Semester I
# M.Statistics      Code: S1PSTP1

(For students admitted from 2018 onwards)
## CC 4 - STATISTICS PRACTICAL – I
**(Based on CC2 and CC3)**

Credits : 5
Hours / Week: 6

**Learning objectives:** Practiced into the sampling methods and distribution techniques based on relevant data.

**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, Multinomial Distribution, Uniform Distribution, Power series Distribution, Laplace Distribution, Weibull Distribution, Logistic Distribution and Cauchy Distribution

**Learning outcomes:** To provide hands on experience in implementation of concepts in Measure and Probability theory, Distribution and Sampling Theory.

## Pattern of Practical
Practical Exam duration: Three Hours
Internal Marks: (Model Practical :25 + Observation :10 + Record Note: 5 = 40 Marks)
 Practical Exam (Lab) :  4 X 15 = 60 Marks

**HOD**                                               **COE**

## Semester II
## M.Statistics            Code: S2PST4
(For students admitted from 2018 onwards)
### CC 5 - STATISTICAL INFERENCE - I
**(Statistical Estimation Theory)**

Credits       : 5
Hours / Week : 6

**Unit I** : Sufficient statistics, Neyman, Fisher Factorisation theorem, the existence and construction of minimal sufficient statistics, Minimal sufficient statistics and exponential family, sufficiency and completeness, sufficiency and invariance.

**Unit II**: Unbiased estimation : Minimum variance unbiased estimation, locally minimum variance unbiased estimators, Rao Blackwell – theorem. Completeness-Lehmann Scheffe theorems, Necessary and sufficient condition for unbiased estimators.

**Unit III**: Cramer- Rao lower bound, Bhattacharya system of lower bounds in the one -parameter regular case. Chapman -Robbins inequality.

**Unit IV**: Maximum likelihood estimation, computational routines, strong consistency of maximum likelihood estimators, Asymptotic Efficiency of maximum likelihood estimators, Best Asymptotically Normal estimators, Method of moments.

**Unit V**: Bayes' and minimax estimation : The structure of Bayes' rules, Bayes' estimators for quadratic and convex loss functions, minimax estimation, interval estimation.

**Text Books and Reference**
V.K.Rohatgi etal(2002) : An introduction to probability and statistics, John Wiley.
Lehmann, E.L. (1983): Theory of point estimation, John Wiley.
Zacks, S. (1971) : The theory of statistical inference, John Wiley.
Rao, C.R. (1973) : Linear statistical inference and its applications, Wiley Eastern, 2nd ed.
Ferguson, T.S. (1967): Mathematical statistics, A decision theoretic approach, Academic press, New York and London.
Lindley, D.V. (1965): Introduction to probability and statistics, Part 2, Inference, Cambridge University Press.
<u>Question Paper Pattern</u>
Maximum Marks:75      Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

HOD                                                                    COE

## Semester II
## M.Statistics      Code: S2PST5
(For students admitted from 2018 onwards)

# CC 6 - MULTIVARIATE ANALYSIS

Credits     : 5
Hours / Week: 6

**Learning objectives:** Students should be proficient in understanding and applying, amongst other topics: the multivariate normal distribution, estimation of the mean vector and covariance matrix, distribution of sample correlation coefficients, the generalized $T^2$ statistic, classification, distribution of the sample covariance matrix.

**Unit I** : Multivariate normal distribution and its properties- 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 II:** Hotelling $T^2$ statistic- Mahanalobis $D^2$ statistic and their distributions & applications- testing the significance of mean vector and equality of mean vectors when the covariance matrices are: (i) known (ii) unknown.

**Unit III:** Wishart distribution- definition, derivation and properties, generalized variance definition and distribution.

**UniI IV:** Concept of classification problem **-** standards of good classification - classification into one of two normal populations- Baye's procedure of misclassification probabilities - Discriminant analysis- Fisher's discriminant function.

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

**Learning outcomes:** To gain a thorough understanding of the details of various multivariate techniques, their purposes, their assumptions, their limitations, and so on.

## Text Books 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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B    5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C    3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                              **COE**

# Semester II
## M.Statistics Code: S2PST6
(For students admitted from 2018 onwards)
## CC 7 - LINEAR MODELS AND DESIGN OF EXPERIMENTS

Credits : 5
Hours / Week : 6

**Learning objectives:** To learn the basic principles of design of experiments like randomization, replication, general design models various designs and multiple comparison tests are studied.

**Unit I** : 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 II:** Factorial experiment- Effects and interactions in $2^2$, $3^2$,$3^3$ experiments. Total and partial confounding. System of confounding for $2^2$ , $2^3$experiments Analysis of Split Plot design.

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

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

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

**Learning outcomes:** Obtain the knowledge of field experiments in agriculture, medicine, marketing, finance and insurance fields.

## Text Books 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

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

## Question Paper Pattern

Maximum Marks:75 Exam duration: Three Hours
Part A 10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B 5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C 3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD** **COE**

# Semester II
# M.Statistics      Code: S2PSTP2
(For students admitted from 2018 onwards)
## CC 8 - STATISTICS PRACTICAL -II
### (Based on CC5,CC6 and CC7)

Credits      : 5
Hours / Week: 6

**Learning objectives:** Practiced into the help of decision making the statistical data based on the statistical inference, multivariate analysis and design of experiment techniques.

**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 $\mu_1 = \mu_2$

Mahalonobis $D^2$ Statistics, Testing for equality of means, Discreminant functions, Principal component analysis.

**Linear Models and Design of Experiments:**

Linear Models and Estimation of BLUE – Analysis of Covariance – Greaco 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.

**Learning outcomes:** To provide hands on experience in implementation of concepts in Statistical Inference, Multivariate Analysis and Linear Model and Design of Experiments.

## Pattern of Practical
Practical Exam duration: Three Hours
Internal Marks: (Model Practical :25 + Observation :10 + Record Note: 5 = 40 Marks)
Practical Exam (Lab) : 4 X 15 = 60 Marks

      **HOD**                                          **COE**

# Semester III
## M.Statistics       Code: S3PST7

(For students admitted from 2018 onwards)
## CC 9 – STATISTICAL INFERENCE II
### (Testing Statistical Hypotheses)

Credits      : 5
Hours / Week : 6

**Unit I**: Uniformly most powerful tests, the Neyman-Pearson fundamental Lemma, Distributions with monotone likelihood ratio. Problems

**Unit II**: Generalization of the fundamental lemma, two sided hypotheses, testing the mean and variance of a normal distribution.

**Unit III** : Unbiasedness for hypotheses testing, similarly and completeness, UMP unbiased tests for multi parameter exponential families, comparing two Poisson and Binomial populations, testing the parameters of a normal distribution (unbiased tests), comparing the mean and variance of two normal distributions.

**Unit IV**: Symmetry and invariance, maximal invariance, most powerful invariant tests.

**Unit V**: SPRT procedures, likelihood ratio tests, locally most powerful tests, the concept of confidence sets, non parametric tests.

**Text Books and Reference**
V.K.Rohatgi et a l(2002) : An introduction to probability and statistics, John Wiley.
Lehmann, E.L. (1986) : Testing of statistical hypothesis, John Wiley.
Ferguson, T.S. (1967) : Mathematical statistics, A decision theoretic approach, Academic press.
Rao, C.R. (1973) : Linear statistical inference and its applications, Wiley Eastern, 2nd ed.
Gibbons, J.D. (1971) : Non-parametric statistical inference, McGraw Hill.

Question Paper Pattern

Maximum Marks:75      Exam duration: Three Hours

Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                         **COE**

(For students admitted from 2018 onwards)

# CC 10 – LINEAR REGRESSION ANALYSIS

Credits      : 5
Hours / Week : 6

Objective: To understand the practical applications of the various regression models and Time series.

**Unit - I**

Simple linear Regression model - Least square estimation of the parameters- Estimation of $\beta_0$ and $\beta_1$- properties of the least square estimators - Estimation of $\sigma^2$- Hypothesis testing on the slope and intercept. Estimation by Maximum likelihood method - Interval estimation in simple linear regression: Confidence Intervals on $\beta_0, \beta_1$ and $\sigma^2$.

**Unit - II**

Multiple linear Regression models - Estimation of model parameters-Least Square estimation of the Regression co.efficients-Properties of least square estimators-Estimation of $\sigma^2$ – Maximum Likelihood Estimation - Hypothesis testing in multiple linear regression, confidence interval in multiple regression co.efficients.

**Unit - III**

Multicollinearity - Sources of multicollinearity - methods for dealing with multicollinearity - Ridge Regression – Specification bias.

**Unit - IV**

Generalized and weighted least squares-Robust regression - Properties of Robust estimators - Non-linear regression models - Generalized linear models-Logistic regression model - Link function and linear predictors

**Unit - V**

Validation of Regression Models – validation techniques, analysis of model coefficient and predicted values, collecting fresh data- confirmation runs, data splitting and data from planned experiments.

**Text Books and Reference**

Douglas C. Montgomery and Elizabeth A.Peck-Introduction to linear Regression Analysis-John Whiley &Sons, New York.

Question Paper Pattern

Maximum Marks:75      Exam duration: Three Hours

Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                              **COE**

# Semester III
## M.Statistics       Code: S3PST9
### (For students admitted from 2018 onwards)
## CC 11 – OPERATIONS RESEARCH

Credits      : 5
Hours / Week : 6

**Learning objectives:** To train the students with Optimization techniques towards solving decision making problems based on deterministic and probabilistic models. To impart an insight of the applications of Operations Research in Management

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

**Unit II:** 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 III:** 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 IV:** 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 V:** 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.

**Learning outcomes:** This paper deals with the theoretical and practical concepts of operations research in LPP, Transportation, Integer programming, Game theory and Inventory models

### Text Books and Reference
**Taha, H.A.**(2007).Operation Research – An Introduction, 8th Edn. Prentice Hall .
**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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B    5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C    3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

       **HOD**                                        **COE**

# Semester III
## M.Statistics                    Code: S3PSTP3
(For students admitted from 2018 onwards)
## CC 12 – STATISTICS PRACTICAL –III
**(Based on CC9 and CC10)**

Credits        : 5
Hours / Week : 6

**Statistical inference II**

Uniformly most powerful tests, Distributions with monotone likelihood ratio testing the mean and variance of a normal distribution. Symmetry and invariance, maximal invariance, most powerful invariant tests.

SPRT, likelihood ratio tests, locally most powerful tests, Non parametric tests.

**Linear Regression analysis**

linear Regression model - Least square estimation of the parameters-Estimation of $\beta_0$ and $\beta_1$- Estimation of $\sigma^2$- Hypothesis testing on the slope and intercept.

Multiple linear Regression models - Estimation of model parameters-Least Square estimation of the Regression coefficients.

Hypothesis testing in multiple linear regression, confidence interval in multiple regression coefficients.

Logistic regression model - Link function and linear predictors

**<u>Pattern of Practical</u>**
Practical Exam duration: Three Hours
Internal Marks: (Model Practical :25 + Observation :10 + Record Note: 5 = 40 Marks)
 Practical Exam (Lab) :  4 X 15 = 60 Marks

**HOD**                                                                                          **COE**

# Semester IV
## M.Statistics      Code : S4PSTP4
(For students admitted from 2018 onwards)
### CC 13 – STATISTICS PRACTICAL IV
**(Based on CC11 and CC13)**

Credits      : 5
Hours / Week : 6

**Learning objectives:** To carried out and practiced in field of the population studies

**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.

Linear Programming Problem - Graphical Method, Simplex Method.

Transportation problem - Balanced and Unbalanced problems - North-West Corner rule, Least cost method, Vogel's approximation method, Test for Optimality; Modi method. Assignment problem - Hungarian method. Sequencing Problem with 'n' jobs and 2 machines, problems with 'n' jobs and 3 machines.

Game theory: Two person Zero sum games; Pure strategy - Mixed strategy ; CPM, PERT.

**Learning outcomes:** To Provide hands on experience in implementation of concepts in Demography.

## Pattern of Practical
Practical Exam duration: Three Hours
Internal Marks: (Model Practical :25 + Observation :10 + Record Note: 5 = 40 Marks)
Practical Exam (Lab) : 4 X 15 = 60 Marks

**HOD**                               **COE**

## Semester IV
## M.Statistics      Code: S4PST10
### (For students admitted from 2018 onwards)
## CC 14 –STATISTICAL QUALITY CONTROL

Credits      : 5
Hours / Week : 6

**Learning objectives:** To provide an insight into quality assessment techniques and an insight into the real-life and varied application of the subject.

**Unit -I:** 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 $\sigma$ charts, np, p, C and U charts, operating characteristic curve for control charts.

**Unit -II:** 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 -III** 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 -IV:** 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 -V:** 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.

**Learning outcomes:** This paper gives an exposure to quality control and its concepts and also explains the reliability concept.

**Text Books and Reference**

**Montgomery,D.C**(1985) Introduction to Statistical Control, John Wiley and Sons,

**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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B    5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C    3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

# Semester IV
## M.Statistics          Code : S4PSTPW
(For students admitted from 2018 onwards)
## CC 15 – PROJECT WORK

Credits        : 5
Hours / Week : 6

**Learning objectives:** To make collected the data in our relevant field and prepare the master tables and analyzed in statistical tools. Finally the presentation and use our social phenomena.

**Dissertation 75 Marks**

**Viva voce 25 Marks**

**Learning outcomes:** To practice the relevant filed work using the statistical tools and delivered valuable conclusions in social phenomena.

**HOD**                                                    **COE**

# PG ELECTIVE COURESES

| Semester | Course | Sub. Code | Title |
|----------|--------|-----------|-------|
| I | EC1 | S1PSTEL1A | Real analysis and linear algebra |
| | | S1PSTEL1B | Advanced Numerical Analysis |
| | | S1PSTEL1C | Deterministic Inventory Models |
| II | EC2 | S2PSTEL2A | Stochastic Processes |
| | | S2PSTEL2B | Non- Parametric Techniques |
| | | S2PSTEL2C | Computer programming with $C^{++}$ |
| III | EC3 | S3PSTEL3A | Statistical Software Packages |
| | | S3PSTEL3B | Bayesian Inference |
| | | S3PSTEL3C | Data mining Tools |
| IV | EC4 | S4PSTEL4A | Demography |
| | | S4PSTEL4B | Statistical Survey  Analysis |
| | | S4PSTEL4C | R-Programming |
| | EC5 | S5PSTEL5A | Actuarial  Statistics |
| | | S5PSTEL5B | Statistical Methods for Epidemiology |
| | | S5PSTEL5C | Official Statistics |

# Semester I
## M.Statistics      Code : S1PSTEL1A
### (For students admitted from 2018 onwards)
## EC1 – REAL ANALYSIS AND LINEAR ALGEBRA

Credits        : 4
Hours / Week : 6

**Learning objectives:** This paper deals with matrix and Re-Mann integrals concepts, convergence and basic theorems.

**Unit I:** 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 II:** Definition of the Riemann integral – Existence of the Riemann integral – Properties of the Riemann integral – Derivatives – Rolle's theorem

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

**Unit IV:** 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 V:** 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- Lagranges method.

**Learning outcomes:** This paper deals with the most significant features of the matrices.

## Text Books and Reference
**Goldberg.R**- Methods of Real Analysis, John Wiley, NY

**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.

Walter Rudin, Real and Complex analysis, Third Edition, Mc. Graw Hill Edn., (India) P.Ltd

## Question Paper Pattern

Maximum Marks:75      Exam duration: Three Hours

Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                                          **COE**

# Semester I
## M.Statistics          Code : S1PSTEL1B
### (For students admitted from 2018 onwards)
## EC1 –    ADVANCED NUMERICAL ANALYSIS

Credits         : 4
Hours / Week : 6

**UNIT –I**
Finite differences-forward and backward differences,operators E and $\Delta$,and their basic properties, Interpolation with equal intervals:Newton's forward and backward differences-simple problems.

**UNIT –II**
Interpolation with unequal intervals:Divided differences and their properties, Newton's divided differences formula and Lagrange's formula for interpolation-simple problems.

**UNIT-III**
Central difference interpolation formula-gauss forward and backward differences formulae-Stirling,Bessel's Everett's central difference formula.

**UNIT –IV**
Inverse interpolation-Lagrange's method-iteration of successive approximation method-simple problems. Numerical differentiation- Numerical differentiation upto second order only-simple problems.

**UNIT –V**
Numerical intergration-Trapezoidal rule-simpsons 1/3rd and 3/8th rules-Weddle's rule-Euler's summation formula.Numerical method of solution of ordinary differential equations-Taylor's series method-Euler method and Runga Kutta upto second order – simple problems.

**Text Books for Reference:**
1. Calculus of finite differences and Numerical analysis by Gupta-Malik, Krishna Prakastan Mandir, Meerut.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.
3. Numerical Analysis by B.D. Gupta, Konark publishing.
4. Calculus of finite differences and Numerical Analysis by Saxena,S. Chand & Co.
5. Numerical mathematics by M.M.Ramasamy and Palaniappan.

<u>Question Paper Pattern</u>
Maximum Marks:75       Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                      **COE**

# Semester I
## M.Statistics     Code : S1PSTEL1C
### (For students admitted from 2018 onwards)
### EC1 – DETREMINISTIC INVENTORY MODELS

Credits     : 4
Hours / Week : 6

**Unit I**

Inventory models – definition – general inventory model – Role of demand in the development of Inventory models.

**Unit II**

Static economic order quantity –EOQ problems – with one price breaks – simple problems.

**Unit III**

Multi items deterministic problems - limitations of inventoris – limitations of storage area.

**Unit IV**

Dynamic EOQ models – set of EOQ model – General dynamic programming algorithm –Programming algorithm with constant or decreasing marginal cost – silver meal heuristic.

**Unit V**

Purchase Inventory model with n price break multi item deterministic model – No set of EOQ model.


**Text Book and Reference**

Hamdy A.Taha Operations Research An Introduction, Pearson(9th Edition)


<u>Question Paper Pattern</u>


Maximum Marks:75     Exam duration: Three Hours
Part A   10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B    5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C    3 x10 = 30 Answer Any **Three** Questions (One question from each unit)


       **HOD**                                                     **COE**

# Semester II
## M.Statistics          Code : S2PSTEL2A
(For students admitted from 2018 onwards)
# EC2 – STOCHASTIC PROCESSES

Credits          : 4
Hours / Week: 6

**Learning objectives:** This paper deals with theoretical and applications of stochastic processes. The concept of Markov chain, stationery probability distribution, birth process, Poisson process, Renewal processes – renewal function are covered in detail.

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

**Unit III:** Discrete Parameter Stochastic Process/time series. Auto- Covariance and Auto-correlation and their properties.

**Unit IV:** 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 V:** Choice of AR and MA terms. Brief discussion of techniques of the ARIMA model parameters and forecasting. Study of Residuals and Diagnostic Checking.

**Learning outcomes:** Stochastic process to developing in time according to Markov chains, Poisson process, the vital process and queues.

## Text Books 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.

**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.

## Question Paper Pattern
Maximum Marks:75      Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

          **HOD**                                                                              **COE**

# EC2 – NON PARAMETRIC TECHNIQUES

Credits      : 4
Hours / Week : 6

**Unit I** : Rank tests for comparing two treatments, Wilcoxon ranksum tests, Asymptotic null distribution of Wilcoxon statistics, Siegel-Tukey and Smirnov tests.

**Unit II:** Power of Wilcoxon rank, sum tests, Asymptotic power, comparison with students t-test, estimating the treatment effect.

**Unit III:** Block comparison for two treatments, sign test for paired comparisons, Wilcoxon signed rank test, a balanced design for paired comparisons, power of sign and Wilcoxon signed rank tests and their comparisons.

**Unit IV:** Comparison of more than two treatments, the Kruskal, Wallis test, 2 x t contingency table, comparing several treatments with a control, ranking several treatments.

**Unit V:** Randomized complete blocks, Friedman, Cochran, McNemar tests, Aligned ranks. Tests of randomness and independence, testing against, trend, testing for independence, zxt contingency tables.

**Text Books and Reference**
Lehmann,E.L.(1975) :Non parameteric:Statistical methods based on Ranks,McGraw Hill.
Gibbons, J.D.(1971) : Non parametric Statistical inference, McGraw Hill.
Hajek, J. and Sidak, Z.(1967) : The theory of rank tests, Academic press.
Hollandar, M. and Wolfe, D.A.(1973) : Non parametric statistical methods, John Wiley.
Walsh, J.F.(1962) : Handbook of non parametric statistics, Van Nostrand.

Question Paper Pattern
Maximum Marks:75      Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

HOD                                                                                          COE

(For students admitted from 2018 onwards)
## EC 2 – COMPUTER PROGAMMING WITH C++

Credits        : 4
Hours / Week: 6

**Learning objectives:** 1. Write clear, elementary C++ programs. 2. Understand algorithmic thinking and apply it to programming. 3. Understand problem-solving techniques.

**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.

**Learning outcomes:** 1. Arm the students with the basic programming concepts.2. Introduce different techniques pertaining problem solving skills 3. Arm the students with the necessary constructs of C++ programming. 4. And to emphasis on guided practical sessions

## Text Books 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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

        HOD                                                                                COE

# Semester III
## M.Statistics        Code : S3PSTEL3A
(For students admitted from 2018 onwards)
## EC 3 - STATISTICAL SOFTWARE PACKAGES

Credits        : 4
Hours / Week : 6

**Learning objectives:** 1. Understand how to start SPSS.  2. Define a variety of statistical variables.  3. Enter basic data into SPSS. 4. Carry out a statistical analysis that can test hypotheses.

**Unit I:** Introduction to Excel – Various Distributions - Descriptive Statistics - Data analysis tools – ANOVA – Covariance - Regression – Correlation – Non parametric tests –– Time series analysis - Using Macros.

**Unit II:** 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 III:** 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 IV:** 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 V:** Introduction to MINITAB 14.2 – Preliminary data analysis – Descriptive statistics – Probability theory – Inferential Statistics for single through multiple samples.

**Learning outcomes:** To develop a resource for students who may lack confidence in mathematics and/or computing. Often, resources that are available involve some mathematics, or are statistics descriptions of the use of the software.

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

## Text Books 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**

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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                          **COE**

# Semester III
## M.Statistics        Code : S3PSTEL3B
(For students admitted from 2018 onwards)
## EC3 – BAYESIAN INFERENCE

Credits        : 4
Hours / Week : 6

**Unit I** : Bayesian point estimation : as a prediction problem from posterior distribution. Bayes estimators for (i) absolute error loss (ii) squared error loss (iii) 0-1 loss.

**Unit II** : Generalization to convex loss functios. Evaluation of the estimate in terms of the posterior risk. theorem – prior and posterior distributions. Conjugate priors and Jeffrey's priors, examples.

**Unit III**: Bayesian interval estimation : Credible intervals. Highest posterior density regions. Interpretation of the confidence coefficient of an interval and its comparison with the interpretation of the confidence coefficient for a classical confidence interval.

**Unit IV**: Bayesian testing of hypotheses : Specification of the appropirate form of the prior distribution for a Bayesian testing of hypothesis problem. Prior odd,s Posterior odds.

**Unit V**: Bayes factor for various types of testing hypothesis problems depending upon whether the null hypothesis and the alternative hypothesis are simple or composite.

**Text Book and References:**

Berger,J.O. : Statistical decision theory and Bayesian analysis, Springler Verlag.
Robert, C.P. and Casella, G.Monte Carlo : Statistical methods, Springer Verlag.
Leonard, T. and Hsu, J.S.J. : Bayesian methods, Cambridge University press.
Degroot, M.H. : Optimal statistical decisions, McGraw Hill.
Bernando, J.M. and Smith, A.F.M. : Baysian theory, John Wiley and sons.
Robert, C.P. : The Bayesian choice : A decision theoretic motivation, Springer.

Question Paper Pattern

Maximum Marks:75      Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                                    **COE**

# Semester III
## M.Statistics        Code : S3PSTEL3C
## EC3– DATA MINING TOOLS

Credits        : 4
Hours / Week : 6

**Unit I**: Data types – Measures of similarity and dissimilarity - Hierarchical Clustering Methods.

**Unit II**: k-means and k-methods clustering methods – Clustering Validity measures

**Unit III**: Fuzzy c-means – Fuzzy Clustering Validity Measures – Decision Trees – Building a decision tree – Tree induction algorithm.

**Unit IV**: Splitting of nodes based on information gain and Gini index - Nearest Neighbor classifiers – kNN algorithm – Naïve Bayesian classifier

**Unit V**: Association rules mining – Basics – Apriori algorithm – Pruning and candidate generation – Rule mining.

**Text Book and References**

Tan, T., Steinbach, M. and Kumar, V. (2006): Introduction to Data Mining, Pearson Education.
Gupta, G.K. (2008): Introduction to Data Mining with case studies, Prentice – Hall of India Pvt. Ltd.
Daniel T. Larose (2006): Data Mining: Methods and Models, John Wiley and Sons.
Han, J. and Kamber, M. (2006): Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publishers.
Paolo Gludici (2003): Applied Data Mining: Statistical Methods for Business and Industry, John Wiley and sons.
Rajan Chattamvelli (2009): Data Mining Methods, Narosa Publishing House, New Delhi.

## Question Paper Pattern
Maximum Marks:75        Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                    **COE**

# EC 4 - DEMOGRAPHY

Credits        : 4
Hours / Week : 6

**Learning objectives:** Gain the knowledge of vital events of fertility, mortality, migration and life tables and their relevant field theory and practical situations.

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

**Unit II:** 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 III:** Definitions- computation of crude death rate, age-specific death rate, infant mortality rate, perinatal mortality rate, neo – ratal mortality and post neornatal mortality rate. Direct and indirect standardization , construction of life tables and their uses.

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

**Unit V:** 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 diagrgated methods.

**Learning outcomes:** To learn out the vital events of fertility, mortality and migration and life tables for based on the population studies.

## Text Books 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, Addision – 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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                                **COE**

## Semester IV
## M.Statistics          Code : S4PSTEL4B
(For students admitted from 2018 onwards)
## EC 4 – STATISTICAL SURVEY ANALYSIS

Credits        : 4
Hours / Week : 6

**Unit - I**
Organizing a statistical survey- Planning the survey, Executing the survey - Drafting an effective questionnaire, difference between questionnaire and schedule.

**Unit - II**
Sampling - Census and Sample method. Sampling and Non-sampling errors.

**Unit - III**
Collection of data - Primary data - methods of collecting primary data. Internet Survey and Telephone Survey. Secondary data - methods of collecting secondary data and precautions while using secondary data.

**Unit - IV**
Classification of data – Types of Classification - Chronological classification, Geographical classification, Quantitative classification and Qualitative classification. Formation of discrete frequency distribution and Formation of continuous frequency distribution.

**Unit - V**
Tabulation of data - Parts of a table and general rules of tabulation. Types of tables - simple and complex table, Machine tabulation and Cross tabulation – Practical Survey and Report Writing.

**Text Book and Reference**
Gupta. S.P, Statistical Methods , Sultan Chand & Sons, New Delhi.

Question Paper Pattern
Maximum Marks:75       Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

        **HOD**                                                                                      **COE**

**M.Statistics    Code : S4PSTEL4C**
(For students admitted from 2018 onwards)
## EC 4 -  R PROGRAMMING

Credits        : 4
Hours / Week : 6

### Unit I

R fundamentals – Components of R Console – Use of Packages – Data Types in

R- Arithmetic, Relational and Logical Operators

### Unit II

Loop Structures – Conditional Structures – Functions

### Unit III

R Graphics – Creating simple graphic applications for Statistical problems

### Unit IV

R packages for sample generation, computing probabilities and fitting probability

distributions.

### Unit V

Building packages in R

### Reference

Online help manuals and other materials available in R project site will form basis
for the course.

<u>Question Paper Pattern</u>

Maximum Marks:75      Exam duration: Three Hours

Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                                                                                                          **COE**

(For students admitted from 2018 onwards)
# EC 5 – ACTUARIAL STATISTICS

Credits       : 4
Hours / Week: 6

**Learning outcomes:** To educate interested students about the applications of statistics in insurance industry. And the several measures are relevant to actuarial statistics.

**Unit I:** 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 II:** 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 III:** 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 IV:** 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 V:** 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.

**Learning outcomes:** To gain the knowledge of the actuaries and an insurance industry. And obtain the financial field and medical immunization programmes analysis.

## Text Books and Reference

**Shailaja D Deshmukh.** Actuarial statistics – university press (India) pvt.Ltd. Hyderbad. (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 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

HOD                                                                                                    COE

## Semester IV
## M.Statistics        Code : S5PSTEL5B
(For students admitted from 2018 onwards)
## EC 5 – STATISTICAL METHODS FOR EPIDEMIOLOGY

Credits       : 4
Hours / Week : 6

**Unit I:** Measures of disease frequency: Mortality / morbidity rates, incidence rates, prevalence rates. Source of mortality / morbidity statistics – hospital records.  Vital statistics records. Measures of secrecy or validity: sensitivity index, specificity index. Measure of reliability.

**Unit II:** Epidemiologic concepts of diseases : Factors which determine the occurrence of diseases, models of transmission of infection, incubation period, disease spectrum and herd immunity.

**Unit III:** Observational studies in Epidemiology: Retrospective (case control) & prospective (cohort or longitudinal) studies. Measures of association : Relative risk, attributable risk. Statistical techniques used in analysis: Cornfield and Garts method, Mantel – Haenszel method. Conditional and unconditional matching. Analysis of data from matched samples, logistic regression approach.

**Unit IV:** Experimental Epidemiology: Clinical and community trials Statistical techniques: Methods for comparison of two treatments. Crossover design with Garts and McNemars test. Randomization in a clinical trials, sequential methods in clinical trials, clinical life tables, assessment of survivability in clinical trials.

**Unit V**: Mathematical modeling in Epidemiology: (deterministic and stochastic) simple epidemic model, generalized epidemic model, Read-Frost and Green-wood models, models for carrier borne and host vector diseases. Estimation of latent and infectious periods, geographical spread of the disease, simulation of an epidemic.

**REFERENCES:**
Kahn, H.A., Sempose, C.T.(1989) : Statistical methods in Epidemiology, Oxford University press.
Daley, D.J., Gani, J.(1999) : Epidemic modeling an introduction, Cambridge.

Question Paper Pattern

Maximum Marks:75      Exam duration: Three Hours
Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)


**HOD**                                                                **COE**

# Semester IV
## M.Statistics     Code : S5PSTEL5C
(For students admitted from 2018 onwards)
## EC 5 – OFFICIAL STATISTICS

Credits     : 4
Hours / Week: 6

Objective : To impart knowledge about the various Statistical Organizations in India.

**Unit - I**
Official Statistics: Definition – Growth of Indian Statistics – Statistical organizations of India: Central Statistical Organisation (CSO) – Divisions of Central Statistical Organisation – Functions – Publications.

**Unit - II**
National Sample Survey Organisation (NSSO) – Divisions of NSSO – Functions of NSSO – Procedure for collection of information – Agriculture Statistics, Yield Statistics – Official series: Traditional method, Random Sampling Method – NSS Series – Forest Statistics, Fisheries Statistics – Defects in agricultural Statistics.

**Unit - III**
National income: Definition – Methods of estimating national income: The Income method, the Output method and the Expenditure method – Uses of National income estimates – Difficulties of estimation.

**Unit - IV**
Social accounting – Population statistics – Sources – Different methods of collecting population census – Methods of enumeration – Merits and demerits of De Facto method, Merits and demerits of the De Jure system.

**Unit - V**
Price Statistics: Wholesale prices, Retail prices, Uses and limitations of price statistics. Industrial Statistics: Main Sources of industrial Statistics – Limitations.

**Text Book and Reference:**
R.S.N. Pillai and V. Bagavathi (1995), Statistics, Third Edition, S.Chand & Company, New Delhi – 110 055.

Central Statistical Organization (1979), Statistical Systems in India, Department of Statistics, Ministry of Planning, New Delhi.

Goon , A.M. Gupta, M.K and Das Gupta, B.(1986), Fundamentals of Statistics, Volume II, The World Press Private Limited, Calcutta.

Question Paper Pattern

Maximum Marks:75    Exam duration: Three Hours

Part A  10 x 2 = 20 Answer **All** Questions (Two questions from each unit)
Part B   5 x 5 = 25 Answer **All** Questions (Either or type-Two questions from each unit)
Part C   3 x10 = 30 Answer Any **Three** Questions (One question from each unit)

**HOD**                       **COE**