RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)
Reaccredited at 'A' Grade by NAAC
(Affiliated to Bharathidasan University, Tiruchirappalli)
Thanjavur – 613 005, TAMIL NADU, INDIA.

BOARD OF STUDIES IN STATISTICS

MINUTES OF THE MEETING HELD ON 05th January 2021

The meeting (review) of the Board of Studies in Statistics, for the Academic Year 2020-21, was held on 5th January 2021 at 2:00 pm at Department of Statistics, Rajah Serfoji Government College, Thanjavur-5.

The following members attended the meeting:

	NAME	MEMBERS	ADDRESS	SIGNATURE
1	V.MURUGESAN	Chairperson	Assistant Professor and Head, Department of Statistics, Rajah Serfoji Government College (Auto), Thanjavur-5.	V.M 5/1/21
2	Dr. H.ALEXIS SELVARAJ	Subject Expert & University Nominee	Assistant Professor and Head, Department of Statistics, Periyar EVR College(Auto), Trichy-23	5/1/21.
3	Dr. M. VIJAYAKUMAR	Subject Expert & Academic Council Nominee	Associate Assistant Professor, Department of Statistics, Annamalai University, Chidambaram - 608002	5/1/21.
4	Dr. S. BHARATHIDASS	Subject Expert	Assistant Professor, Department of Statistics , Periyar EVR College(Auto), Trichy-23	05/01/2021
5	S.SELVAM	Industrialist	Asst. Director of Statistics, New collectrate, Tamil University Post, Thanjavur – 613 006	–
6	S.MEENA	Alumni	32, Suriya Nagar, Srinivasapuram, Thanjavur 613009	–
7	M.RAJAN	Faculty Member	Assistant Professor, Department of Statistics, Rajah Serfoji Government College (Auto), Thanjavur-5.	5/1/21

RAJAH SERFOJI GOVERNMENT COLLEGE
(AUTONOMOUS) NAAC "A" GRADE
THANJAVUR-613005

PG DEPARTMENT OF STATISTICS

PG PROGRAMME: M.Sc., STATISTICS

CBCS - COURSE PATTERN (2018 -2019 onwards)
BOARD OF STUDIES REVIEW 2020-2021(Dt: 05.01.2021)
SEMESTER WISE DISTRIBUTION OF PAPERS (COURSES)

COURSE: M.Sc. STATISTICS

PROGRAMME OBJECTIVES

1. To imbibe strong foundation of statistics in students.
2. To familiarize students with basic to high-level statistical concepts.
3. To update students with mathematical tools that aid in statistical theory.
4. To teach/strengthen students' knowledge of spreadsheets, programming languages and statistical software packages.
5. To promote application-oriented pedagogy by exposing students to real world data.
6. Preparing students for statistics related competitive exams and motivated them.
7. To make students do projects this prepares them for jobs ahead.

PROGRAMME OUTCOMES (POs)

On completion of the programme, the leaner will be able to

PO-1: Apply the knowledge of Statistics, science, arts and management principles to the solution of complex problems.

PO-2: Devise solutions for intricate problems and plan system components or processes that meet the specified needs with appropriate consideration for the society, health , safety, cultural, societal, and environmental considerations.

PO-3: Use innovation-based knowledge and creative methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-4: Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modeling to complex activities with an understanding of the limitations.

PO-5: Comprehend the influence of the proficient clarifications in societal and environmental context for sustainable development.

PO-6 : Pertain ethical principles and entrust to professional ethics and responsibilities.

PO-7 : Function effectively as an individual, and in assorted teams.

PO-8 : Communicate effectively on various activities and make effective presentations.

PO-9 : Exhibit comprehension and understanding of the programmes and apply them in a multidisciplinary environment.

PO-10: Be familiar with the need for and have the training and skill to engage in self regulating and life-long learning in the broadest perspective of hi-tech change.

Programme Specific Outcomes (PSOs)

PSO-1 : Students will be enriched with technical skills used in statistical data science, data analytics through projects including big data

PSO-2 : Students are enhanced with the skills of creating taxonomy of cognitive domain in Statistics(Knowledge, Comprehension, Application, Analysis, Synthesis, evaluation)

PSO-3: Students will learn numerical aptitude applying both qualitative and quantitative knowledge for their future career.

PSO-4 : Students are stimulated with self learning skills that help them in research work in future and also to perform in NET, SLET and GATE.

PSO-5 : Students are groomed up with the present and advanced analytical skills that help them to be an entrepreneur or advisor in Data analytics and Predictive Modeler domain.

PSO-6 : Students can utilize their statistical skills, computation and comprehensive knowledge in other disciplinary courses and projects.

PSO-7 : Students can increase their competency and perform well in government and Central government jobs for statistics like ISS (Indian Statistical Service), UPSC.

PSO-8 : Students can synthesize their statistical expertise in Medical research, Finance and can work as a prominent part in the medical survey, research analytics.

PSO-9 : Students will be incorporated with the knowledge of data impurity and handling them with statistical techniques and well known with the automation of building a new statistical model with the criteria, assumptions and appropriateness

PSO-10: Students will be able to do Statistical softwares which will be very useful for their research programs.

PSO-11: Elective papers in PG Programme enable the students to face the real time applications and more useful for the students to do their research programs in future.

RAJAH SERFOJI GOVERNMENT COLLEGE (AUTOMONOUS), THANJAVUR-5
C.B.C.S. PATTERN FOR ALL P.G. COURSES
M.Sc., STATISTICS
[Applicable to the students admitted from the academic year (2018-2019) onwards]

PART	CODE	COURSE	TITLE	HRS / WEEK	MARKS		TOTAL	EXAM HOURS	CREDIT
			I SEMESTER		**IA**	**AE**			
III	**S1PST1**	**CC1**	Measures and Probability Theory	6	25	75	100	3	5
III	**S1PST2**	**CC2**	Advanced Distribution Theory	6	25	75	100	3	5
III	**S1PST3**	**CC3**	Advanced Sampling Theory	6	25	75	100	3	5
III	**S1PSTP1**	**CC4**	Practical – I (CC2&CC3)	6	40	60	100	3	4
III	**S1PSTEL1A**	**EC1**	Real Analysis and Linear Algebra	6	25	75	100	3	4
	S1PSTEL1B		Advanced Numerical Analysis						
	S1PSTEL1C		Deterministic Inventory Models						
			TOTAL	**30**			**500**		**23**
			II SEMESTER		**IA**	**AE**			
III	**S2PST4**	**CC5**	Statistical Inference – I	6	25	75	100	3	5
III	**S2PST5**	**CC6**	Multivariate Analysis	6	25	75	100	3	5
III	**S2PST6**	**CC7**	Linear Models and Design of Experiments	6	25	75	100	3	4
III	**S2PSTP2**	**CC8**	Practical – II (CC5 , CC6 & CC7)	6	40	60	100	3	4
III	**S2PSTEL2A**	**EC2**	Stochastic Processes	6	25	75	100	3	4
	S2PSTEL2B		Non-Parametric Techniques						
	S2PSTEL2C		Computer Programming with C++						
			TOTAL	**30**			**500**		**22**

			III SEMESTER		IA	AE			
III	**S3PST7**	**CC9**	Statistical Inference – II	6	25	75	100	3	5
III	**S3PST8**	**CC10**	Linear Regression Analysis	6	25	75	100	3	5
III	**S3PST9**	**CC11**	Operations Research	6	25	75	100	3	5
III	**S3PSTP3**	**CC12**	Practical –III(CC9,CC10 &CC11)	6	40	60	100	3	4
	S3PSTEL3A		Statistical Software Packages						
III	**S3PSTEL3B**	**EC3**	Bayesian Interface	6	25	75	100	3	4
	S3PSTEL3C		Data Mining Tools						
IV	**S3PSTEC**	***ECC1**			-	-	100	3	4
			TOTAL	**30**			**500**		**23**
			IV SEMESTER		**IA**	**AE**			
III	**S4PST10**	**CC13**	Statistical Quality Control	6	25	75	100	3	5
III	**S4PSTP4**	**CC14**	Practical – IV (CC13 & EC4)	6	40	60	100	3	5
III	**S4PSTPW**	**CC15**	**Project Work**	6	20	80	100		4
	S4PSTEL4A		Demography						
III	**S4PSTEL4B**	**EC4**	Statistical Survey Analysis	6	25	75	100	3	4
	S4PSTEL4C		R – Programming						
	S4PSTEL5A		Actuarial Statistics						
III	**S4PSTEL5B**	**EC5**	Statistical Methods for Epidemiology	6	25	75	100	3	4
	S4PSTEL5C		Official Statistics						
IV	**S4PSTEC**	***ECC2**			-	-	100	3	4
			TOTAL	**30**			**500**		**22**
			GRAND TOTAL				**2000**		**90**

Semester - I

M.Sc., Statistics Code: S1PST1

(For students admitted from 2018 onwards)

CC 1 - MEASURE AND PROBABILITY THEORY

Credits : 5 Hours / Week : 6

Course Objectives:

1. To impart knowledge in the measure and probability theory.
2. To develop skills and to acquire knowledge on basic concepts of Lebesgue Measure, The Lebesgue Integral, Measurable Functions, L p - spaces, Minkowski inequalities, Holder inequalities, Convergence and completeness.
3. To illustrate probabilistic pre-requisites 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.

Course outcomes:

At the end of the course, the Students will be able to		Cognitive Level
CO -1	Knowledge and understanding: understanding basic concepts of measure and integration theory.	**Un**
CO -2	Application: measure theory is a part of the basic curriculum since it is crucial for understanding the theoretical basis of probability and statistics.	**Ap**
CO -3	To learn how to analysis the measure and measurable functions, definition of random variable, distribution function and concepts of convergence of distribution.	**Ay**
CO -4	Transferable skills: Ability to use abstract methods to solve problems. Ability to use a wide range of references and critical thinking.	**E**
CO -5	Solve the problems based on WLLN, SLLN and CLT. Understanding of the characteristics functions and related results.	**Pr**

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Books and Reference

B.R.Bhat. Modern probability theory

Mark Fisz. Probability theory and mathematical statistics

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.Sc., Statistics Code: S1PST2

(For students admitted from 2018 onwards)

CC 2 - ADVANCED DISTRIBUTION THEORY

Credits : 5 Hours / Week: 6

Course objectives:

1. To learn basic and advanced techniques in distributions and their properties, characteristics.
2. To present the general theory of statistical distributions as well as the standard distributions found in statistical practice.
3. Understanding through real-world statistical applications.

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.

Unit-III Discrete uniform, Power series, Laplace, Weibull, Logistic, and Cauchy distributions – Definitions properties, moments and its applications.

Unit-IV Concept of Sampling distributions, Non-central Chi-Square, t and F distributions and their properties.

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.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand the most common discrete and continuous probability distributions and their real life applications.	Un
CO -2	Apply compound, Truncated, mixture and non-central probability distributions to solve problems.	Ap
CO -3	Analysis marginal and conditional distributions from joint distributions.	Ay
CO -4	Acumen to apply standard discrete probability distribution to different situations.	E
CO -5	Get familiar with transformation of univariate and multivariate densities. Understanding of distribution helps to understand the nature of data and to perform appropriate analysis.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Books and Reference

Rohatgi, V.K. (1984) Introduction to Mathematical Statistics, Wiley Eastern.
Gupta, S.C. & Kapoor,V.K.(1977) Fundamentals of Mathematical Statistics, SultanChand & Sons.

Question Paper Pattern

Maximum Marks:75Exam 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.Sc.,Statistics Code: S1PST3

(For students admitted from 2018 onwards)

CC 3 - ADVANCED SAMPLING THEORY

Credits : 5 Hours / Week: 6

Course Objectives:

1. To learn scientific view to conduct the survey in proper way to collect the data about specific perspective.
2. To Learn variety of probability and non probability sampling methods for selecting a sample from a population.

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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand the basic principles underlying survey design and estimation.	Un
CO -2	Apply the different sampling methods for designing and selecting a sample from a population.	Ap
CO -3	Implement Cluster sampling, Ratio and Regression estimation in real life problems.	E
CO -4	To apply various sampling methods for agricultural data.	Ay
CO -5	To use practical applications of ratio and regression method of estimation.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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.Sc., Statistics Code: S1PSTP1

(For students admitted from 2018 onwards)

CC 4 - PRACTICAL – I (Based on CC2 and CC3)

Credits : 4 Hours / Week: 6

Course Objectives:

1. Practiced into the sampling methods and distribution techniques based on relevant data.
2. This course is based on both Based on CC2 and CC3 and will provide practical knowledge to the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

Sampling Theory

Sample size estimation – Simple Random Sampling, Stratified Random Sampling with Allocations, Systematic 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

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Estimate the parameter of a distribution from sample and give conclusions.	Un
CO -2	Hands on experience in implementation of concepts in Measure and Probability theory.	Ap
CO -3	Analyse and Solve the problems related to distribution function.	E
CO -4	Apply regression analysis technique real life problems.	Ay
CO -5	Practice and Implement various sampling methods, Ratio and Regression estimation in real life problems.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Pattern of Practical :

Practical Exam duration: Three Hours

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

Practical Exam (Lab): 4X15=60 marks.

HOD **COE**

Semester II

M.Sc., Statistics **Code: S2PST4**

(For students admitted from 2018 onwards)

CC 5 - STATISTICAL INFERENCE - I

(Estimation Theory)

Credits: 5 Hours / Week: 6

Course objectives:

1. To analyse the need for estimation techniques in Communication and Signal Processing
2. To analyse estimation problems and apply suitable estimation and detection techniques.
3. To Analyse signal or parameter estimation techniques are preferred and develop
4. Estimation techniques that is suitable for the context from a wider perspective
5. To Analyse impact of white Gaussian noise on Detection of Signals

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 Baye's and minimax estimation: The structure of Baye's' rules, Baye's' estimators for quadratic and convex loss functions, minimax estimation, interval estimation.

Course Outcomes

After going through this course, the students will get		**Cognitive Level**
CO -1	A fundamental understanding of Parametric models for developing relevant inferences on associated parameters	Un
CO -2	Knowledge of point and interval estimation procedures and different methods of point estimation	Sk
CO -3	Gaining the concepts of solve the data based on the testing of hypothesis.	An
CO -4	To evaluate understand the Cramer-Rao Inequality, Rao Blackwell and Lehmann Scheffe theorems and their applications in obtaining Minimum Variance Unbiased and Minimum Variance Bound estimators	E
CO -5	To work on several standard examples to help them understand the various inherent concepts. And design and implement the solutions to problems that are critical to humanity and demonstrate computational skills to implement various statistical inferential approaches.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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.

Question Paper Pattern

Maximum Marks:75Exam 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.Sc., Statistics Code: S2PST5

(For students admitted from 2018 onwards)

CC 6 - MULTIVARIATE ANALYSIS

Credits: 5 Hours / Week: 6

Course Objectives:

1. To learn and develop scientific view to deal with multidimensional datasets and its uses in the analysis of research data.
2. To understand the extensions of univariate techniques to multivariate frameworks and learn to apply dimension reduction techniques used in the data analysis.
3. Understand the characteristics of multivariate quantitative research, including strengths and weaknesses
4. Understand the principles and characteristics of the multivariate data analysis techniques

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.

Unit-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.

Course Outcomes

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand multivariate normal distribution and their real life applications.	Un
CO -2	Understand Wishart distribution, Hotelling T^2 and Mahalanobis D^2 statistic.	Ap
CO -3	Implement dimension reduction techniques using software on real life problems.	Ay
CO -4	Demonstrate knowledge and understanding of the basic ideas behind discriminant and clustering analysis techniques with applications.	E
CO -5	Gaining the knowledge for the Multiple and Partial Correlation and their tests of significance, Multivariate Normal Distribution and its properties	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code: S2PST6

(For students admitted from 2018 onwards)

CC 7 - LINEAR MODELS AND DESIGN OF EXPERIMENTS

Credits: 4 Hours / Week: 6

Course objectives:

1. To learn the basic principles in the design of simple experiments.
2. To learn different tests for comparing pairs of treatment means, ANCOVA, factorial experiments, fractional factorial experiments, confounding, BIBD, PBIBD with solving real life examples.
3. To learn the applications of different designs in agriculture.
4. The course includes a review of the modest probability and statistics background necessary for conducting and analyzing scientific experimentation.

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 , 2^3experiments 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 associate classes. Parametric relations and intra block analysis of PBIBD. 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.

Course Outcomes

At the end of the course the Students will be able to		**Cognitive Level**
CO-1	Describe how to design experiments, carry them out, and analyze the data they yield	Un
CO-2	Examine how a factorial design allows cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process; and discuss its advantages to those who conduct the experiments as well as those to whom the results are reported.	Ap
CO-3	Construct fractional factorial experiments and apply confounding in real life problems.	An
CO-4	Evaluate the analysis of BIBD, PBIBD, Latin square, Youden square and cross over design and their applications in agriculture, business and industries.	E
CO-5	To apply various designs for agricultural data/agricultural field	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc.,Statistics Code: S2PSTP2

(For students admitted from 2018 onwards)

CC 8 - PRACTICAL -II

(Based on CC5, CC6 and CC7)

Credit: 4 Hours / Week : 6

Course Objectives:

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

2. This course is based on both Based on CC5, CC6 and CC7 and will provide practical knowledge o the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

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 factorial experiments with and without, total and partial confounding - BIBD – PBIBD - Youden Square Design – Lattice Design.

Course Outcomes

At the end of the course the Students will be able to		Cognitive Level
CO -1	Demonstrate the concepts of point and interval estimation of unknown parameters and their significance using large and small samples. And Apply the idea of sampling distributions of difference statistics in testing of hypotheses.	Un
CO -2	Will appreciate the opportunities for using statistical techniques of multivariate analysis to summarise and interpret complex sets of data	Ap
CO -3	Will be able to use multivariate techniques appropriately, undertake multivariate hypothesis tests, and draw appropriate conclusions.	Ay
CO -4	Understand and use the terminology of experimental designs.	An
CO -5	Hands on experience in implementation of concepts in Statistical Inference, Multivariate Analysis and Linear Model and Design of Experiments.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Pattern of Practical :

Practical Exam duration: Three Hours

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

Practical Exam (Lab): 4X15=60 marks.

HOD **COE**

M.Sc., Statistics **Code: S3PST7**

(For students admitted from 2018 onwards)

CC 9 – STATISTICAL INFERENCE - II

(Testing Statistical Hypothesis)

Credits: 5 Hours / Week: 6

Course Objectives:

Transformations and moments of random variables for the familiar of distributions. Inequalities and convergence theorems, sufficient statistics by using the various powerful tests.

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 hypothesis, testing the mean and variance of a normal distribution.

Unit-III Unbiasedness for hypothesis 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 and Non parametric tests.

Course Outcomes:

By the end of this Programme, the students will be able to		**Cognitive Level**
CO -1	To obtained the gained the SPRT procedure for using the various most powerful invariant tests.	Un
CO -2	To provide the knowledge of parametric and non parametric tests.	Ap
CO -3	Understand problem of statistical inference, problem of testing of hypothesis and construct SPRT in case of Binomial, Poisson, and Normal Distribution.	Ay
CO -4	Understand Generalized Neyman Pearson lemma, unbiased test, UMPUT and their existence in case of exponential family and similar tests and tests with Neyman structure.	E
CO -5	Developed the knowledge for the field for fundamental lemma's and theorems.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Books and Reference

V.K.Rohatgi (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:75Exam 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.Sc., Statistics Code: S3PST8

(For students admitted from 2018 onwards)

CC 10 – LINEAR REGRESSION ANALYSIS

Credits: 5 Hours / Week: 6

Course objectives:

1. To develops a deeper understanding of the linear and non-linear regression model and its limitations.
2. To learn how to develop regression model and apply for the specific perspective data appropriate manner.
3. To understand the practical applications of the various regression models and Time series.
4. Regression analysis is the most common statistical modeling approach used in data analysis and it is the basis for advanced statistical modeling.
5. In this course, students will learn the use of different useful tools used in regression analysis. They will learn about simple and multiple linear regression, non-linear regression and Generalise linear models (GLM) including logistic regression.

Unit-I Simple linear Regression model - Least square estimation of the parameters- Estimation of β_0 and β_1- properties of the least square estimators - Estimation of σ^2- Hypothesis testing on the slope and intercept. Estimation by Maximum likelihood method - Interval estimation in simple linear regression: Confidence Intervals on β_0,β_1 and σ^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 σ^2 – Maximum Likelihood Estimation - Hypothesis testing in multiple linear regression, confidence interval of 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.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand multiple linear regression models with applications and concept of Multicollinearity and autocorrelation.	Un
CO -2	Apply Logistic and Non-linear regression models and its implementation in real life situation.	Ap
CO -3	Compute multiple and partial correlation and checking residual diagnostic to validate model.	E
CO -4	Apply simple linear regression model to real life examples.	Ay
CO -5	Develop a deeper understanding of the linear regression model. Differentiate between linear and non-linear regression and how to apply them in real life situations.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Books and Reference

1. Douglas C. Montgomery and Elizabeth A.Peck-Introduction to linear Regression Analysis-John Whiley &Sons, New York.
2. Alvin C.Rencher and G.Bruce Schaalje – Linear Models in satatistics – Wiley –John whiley & sons,Newyork.
3. Samprit Chatterjee ALI .S.HADI – Regression Analysis by example Fourth edition John wiley & sons Newyork.
4. Frank E. Harvell , Introduction Regression Modelling strategies: with applications to linear models , logistic regression and survival analysis – Springev series Newyork.

Question Paper Pattern

Maximum Marks:75Exam 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.Sc.,Statistics Code: S3PST9

(For students admitted from 2018 onwards)

CC 11 – OPERATIONS RESEARCH

Credits: 5 Hours / Week: 6

Course Objectives:

1. To develop the optimization techniques that will be useful in the personal and professional life.
2. To learn the mathematical formulation of complex decision-making problems and arrives at optimal or near-optimal solutions using different techniques of operations research.
3. To impact knowledge in concepts and tools of operations research.
4. To understand mathematical models used in operations research.
5. To apply these techniques constructively to make effective business decisions.

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.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand basics and formulation of linear programming problems and appreciate their limitations; solve linear programming problems using graphical method.	Un
CO -2	Gain knowledge about sequencing problems, travelling salesman problem and various methods to solve sequencing problems.	Ap
CO -3	Analyse and Solve artificial variable technique, duality theory, revised simplex method, sensitivity analysis,transportation and assignment problems.	Ay
CO -4	Evaluate and apply simplex method to solve real life problems	E
CO -5	Be able to build and solve Game theory, PERT/ CPM, simulation, investment analysis with real life applications.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice.

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:75Exam 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.Sc. Statistics Code: S3PSTP3

(For students admitted from 2018 onwards)

CC 12 – PRACTICAL –III

(Based on CC9, CC10 and CC11)

Credits : 4 Hours / Week: 6

Course objectives:

1. It assists the students practically to make use of the statistical data, based on the statistical inference, Linear Regression analysis and Operations Research.
2. This course is based on both Based on CC9, CC10 and CC11 and will provide practical knowledge to the students on various topics elaborated in these two courses so that they can apply the relevant concepts to real life problems.

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 β_0 and β_1- Estimation of σ^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.

Operations Research

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, n-jobs and 3 machines.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand Hypothesis various advanced statistical techniques for modelling and exploring practical situations.	Un
CO -2	Solving the problems related to testing of hypothesis (Large sample & small sample test)	Ap
CO -3	Enables to solve suitable problems of LPP and implement practical cases of decision making under different environments.	Ay
CO -4	Hands on experience in implementation of concepts in Statistical Inference, Linear Regression analysis and Operations Research.	E
CO -5	Practice and Develop a deeper understanding of the linear regression model.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice.

Pattern of Practical :

Practical Exam duration: Three Hours

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

Practical Exam (Lab): 4X15=60 marks.

HOD **COE**

Semester IV

M.Sc., Statistics **Code: S4PST10**

(For students admitted from 2018 onwards)

CC 13 –STATISTICAL QUALITY CONTROL

Credits: 5 Hours / Week: 6

Course objectives:

1. To develop scientific view to analyze the industrial data about specific perspective.
2. To learn the statistical quality control techniques used in industries such as control charts, acceptance sampling plans etc.
3. To learn some advanced control charts, capability indices and the concept of six-sigma.

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 σ 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 Roming 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.

** Visit to various industry and processing unit for data collection is compulsory.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand basic of production process monitoring and apply concept of control charts on it.	Un
CO -2	Apply the acceptance and continuous sampling plans in production process.	Ap
CO -3	Compute capability indices.	E
CO -4	Know and apply the concept of weighted control charts, six sigma, ISO: 2000 series standards and designs.	Ay
CO -5	Effectively interpret the results form the control charts	E

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice..

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:75Exam 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.Sc.,Statistics Code : S4PSTP4

(For students admitted from 2018 onwards)

CC 14 – PRACTICAL IV

(Based on CC13 and EC4)

Credits: 5 Hours / Week: 6

Course Objectives:

To carried out and practiced in field of the industrial area and population studies.

Statistical Quality Control

Control Charts for $\bar{X}$ Chart, 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.

Demography

Measurement of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR).

Measurement of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality Rate (IMR), Standardized Death Rate (SDR- Direct And Indirect Method) and Life Tables. Industrial visit: Various data collection – Apply and practice in statistical tools and techniques.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand MP and UMP test.	Un
CO -2	Apply different designs in real life situations.	Ap
CO -3	Train to Draw controls charts and apply acceptance sampling plans in industry point of view.	Ay
CO -4	To Provide hands on experience in implementation of concepts in Demography.	E
CO -5	Real data implementation of various demographic concepts as outlined above through practical assignments.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Pattern of Practical :

Practical Exam duration: Three Hours

Internal Marks:

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

Practical Exam (Lab): 4X15=60 marks.

HOD **COE**

M.Sc., Statistics Code : S4PSTPW

(For students admitted from 2018 onwards)

CC 15 – PROJECT WORK

Credits: 4 Hours / Wee: 6

Course 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 80 Marks

Viva voce 20 Marks

Course Outcomes :

Students will opt for a compulsory Project work in Semester VI. At the end of this project, the Students will be able to		**Cognitive Level**
CO -1	Search primary or secondary dataset and collect the data for analysis. Analyze and interpret and take appropriate decisions in solving real life problems using statistical tools.	Un
CO -2	Use different Statistical packages for graphical interface, data analysis and interpretation.	Ap
CO -3	Interpret and conclude the statistical analysis scientifically.	Ay
CO -4	Write a systematic Statistical project report. Represent his/her work through power point presentation.	E
CO -5	Apply the statistical techniques in the project which they had learned in the theory.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice.

HOD **COE**

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	**S4PSTEL5A**	Actuarial Statistics
		S5PSTEL5B	Statistical Methods for Epidemiology
		S5PSTEL5C	Official Statistics

Semester I

M.Sc.,Statistics Code : S1PSTEL1A

(For students admitted from 2018 onwards)

EC1 – REAL ANALYSIS AND LINEAR ALGEBRA

Credits: 4 Hours / Week: 6

Course Objectives:

1. The aim of the course is to introduce fundamental concept of real analysis such as sequence, series of real numbers and their convergence, continuity, differentiability of real valued functions.
2. To learn the basic ideas of abstract algebra and techniques with proof in pure mathematics and further, it can be use in many other courses.

Unit-I Sets and elements- Operations and sets, functions - Real valued function- equivalence, countability and areal numbers. Sequence – definition, limit, convergent, divergent, bounded and monotone sequences. Series – definition – convergence and divergence.

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- Lagrange's method.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand abstract ideas and rigorous methods in mathematical analysis to solve practical problems.	Un
CO -2	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.	Ap
CO -3	Comprehend rigorous arguments developing the theory underpinning real analysis.	Ay
CO -4	Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration. Construct rigorous mathematical proofs of basic results in real analysis.	E
CO -5	Practiced the conditions for intergrability of a real valued function.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Books 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:75Exam 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 : S1PSTEL1B

(For students admitted from 2018 onwards)

EC1 – ADVANCED NUMERICAL ANALYSIS

Credits: 4 Hours / Week : 6

Course Objectives:

1. The course aims to provide students with the specialized knowledge in advanced numerical analysis.
2. Understand analytical, developmental and technical principles that the relate to numerical linear algebra, numerical methods for solving differential equations.

Unit-I Finite differences-forward and backward differences, operators E and Δ, 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 integration-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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand for the implementation of theories in problem solving.	Un
CO -2	Implementation of the knowledge of basic theorems and concepts in the different area of the mathematics	Ap
CO -3	Knowledge of different area of research in mathematical statistics.	Ay
CO -4	Ability to understand the different math concepts and be able to implement them in our everyday problems.	E
CO -5	Efficient use of the techniques, skills and tools of modern mathematics.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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.

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.Sc. Statistics Code: S1PSTEL1C

(For students admitted from 2018 onwards)

EC1 – DETERMINISTIC INVENTORY MODELS

Credits: 4 Hours / Week: 6

Course Objectives:

1. To ensure a continuous supply of materials and stock so that production should not suffer at time of customers demand.
2. To avoid both over stocking and under – stocking of inventories.

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 inventories – 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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand the methods used by organisation to obtain the right quantities of stock or inventory.	Un
CO -2	The stochastic models possess some inherent randomness.	Ap
CO -3	The output of the model is fully determined by the parameter values and initial conditions.	Ay
CO -4	The same set of parameter values and initial conditions will lead to an ensemble of different outputs.	E
CO -5	Case study requires student's comprehension of inventory management and emphasizes supply chain management applications.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Book and Reference

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

Question Paper Pattern

Maximum Marks:75Exam 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.Sc.,Statistics Code : S2PSTEL2A

(For students admitted from 2018 onwards)

EC2 – STOCHASTIC PROCESSES

Credits: 4 Hours / Week: 6

Course Objectives:

1. To learn and to understand stochastic processes predictive approach.
2. To develop an ability to analyze and apply some basic stochastic processes for solving real life situations.
3. 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 studies 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.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand the stochastic processes, Markov chains, Transition probability matrix and various types of states.	Un
CO -2	Explain Random walk, Gambler ruins problem and apply Poisson process in real life situations.	Ap
CO -3	Skills. The student is able to formulate simple stochastic process models in the time domain and provide qualitative and quantitative analyses of such models. Formulate and solve problems which involve setting up stochastic models.	Ay
CO -4	Understand renewal theory and branching processes with applications. Also Stochastic process to developing in time according to Markov chains, Poisson process, the vital process and queues.	E
CO -5	Solve differential equations for distributions and expectations in time continuous processes and determine corresponding limit distributions.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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.

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.

Question Paper Pattern

Maximum Marks:75Exam 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.Sc., Statistics **Code: S2PSTEL2B**

(For students admitted from 2018 onwards)

EC2 – NON PARAMETRIC TECHNIQUES

Credits : 4 Hours / Week:6

Course Objectives:

1. Awareness of advanced theoretical and applied information supported by the statistical sources.
2. The significance and impact of statistical methods on the social dimensions of inter disciplinary studies.

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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	We are able to acquire the knowledge of statistics its scope and importance in various areas such as medical, engineering, agricultural and social sciences.	Un
CO -2	Gaining the knowledge of other social types of data reflecting quality characteristics including the concepts of independent and association between two or more attributes.	Ap
CO -3	Analyse non parametric statistical techniques	Ay
CO -4	Formulate test and interpret various hypothesis test for location, scale and independence problems.	E
CO -5	The students will have knowledge of Various one sample tests NPT such as test of randomness ,Sign test ,Kolmogorov Smirnov (KS) test and Kaplan –Meier Estimator	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code: S2PSTEL2C

(For students admitted from 2018 onwards)

EC 2 – COMPUTER PROGAMMING WITH C++

Credits: 4 Hours / Week: 6

Course Objectives:

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

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

Unit-IV 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-V 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.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Understand and trace the execution of programs written in C ++ language.	Un
CO -2	Arm the students with the basic programming concepts.	Ap
CO -3	Introduce different techniques pertaining problem solving skills	Ay
CO -4	Arm the students with the necessary constructs of C++ programming.	E
CO -5	To emphasis on guided practical sessions	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code : S3PSTEL3A

(For students admitted from 2018 onwards)

EC 3 - STATISTICAL SOFTWARE PACKAGES

Credits: 4 Hours / Week: 6

Course 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.
5. To learn statistical techniques and their implementation using comprehensive SPSS software.

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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand statistics environment related software packages.	Un
CO -2	Get familiar with SPSS software and understand SPSS	Ap
CO -3	Create and edit the data files, plot graphs using SPSS.	Ay
CO -4	Compute descriptive statistics using SPSS.	E
CO -5	Perform inferential statistical analysis through SPSS.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code : S3PSTEL3B

(For students admitted from 2018 onwards)

EC3 – BAYESIAN INFERENCE

Credits : 4 Hours / Week: 6

Course Objectives:

The course aims to introduce the concept of Bayesian inference, concept of loss functions, risk function, prior and posterior distribution and their application in various real fields.

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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand the concepts of prior and posterior distributions	Un
CO -2	Be able to differentiate between classical and Bayesian inference.	Ap
CO -3	Applications of various loss and risk functions.	Ay
CO -4	Be able to apply the concept of Bayesian inference in different fields of applications.	E
CO -5	Develop the Bayesian frame work for data analysis and its flexibility and be able to demonstrate.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code : S3PSTEL3C

(For students admitted from 2018 onwards)

EC3– DATA MINING TOOLS

Credits : 4 Hours / Week : 6

Course Objectives:

1. To learn basic data mining techniques and their handling using R software.
2. To introduce the basic concepts and techniques of data mining.
3. To develop skills of using recent data mining software for solving practical problems.

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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand fundamentals of data mining.	Un
CO -2	Understand data warehousing, OLAP, OLTP, Data visualization.	Ap
CO -3	Implement and interpret the results of data scientifically using R software.	Ay
CO -4	Evaluate different models used for data pre processing.The purpose of paper, participate more online activities proposed.	Ev
CO -5	Know feature and applications of data mining.	C

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code: S4PSTEL4A

(For students admitted from 2018 onwards)

EC 4 - DEMOGRAPHY

Credits: 4 Hours / Week : 6

Course Objectives:

1. To identify appropriate sources of data and to perform basic demographic analyses using various techniques across populations.
2. To learn the main theories used to understand population studies and societal change.
3. 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–natal mortality and post neo natal mortality rate. Direct and indirect standardization, construction of life tables and their uses.

Unit-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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand the measures of mortality, fertility and interdisciplinary nature of demography, balancing equation, use of indices.	Un
CO -2	Describe the concept of life tables.	Ap
CO -3	Apply Quasi, stable population models.	Ay
CO -4	To learn out the vital events of fertility, mortality and migration and life tables for based on the population studies.	E
CO -5	Real data implementation of various demographic concepts as outlined above through practical assignments.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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,

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.Sc., Statistics Code : S4PSTEL4B

(For students admitted from 2018 onwards)

EC 4 – STATISTICAL SURVEY ANALYSIS

Credits : 4 Hours / Week: 6

Course Objectives:

1. Students should know the steps involved in qualitative data collection.
2. Students should know the types of qualitative data typically collected in a qualitative study.
3. Identify and discuss the role and importance of research in the social sciences.
4. This course describes the various methods used for modeling and evaluating survival data.

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.

Course Outcomes

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	After completing this course we will be able to describe survival data format it appropriately for analysis and understanding.	Un
CO -2	Apply the knowledge for Survival analysis including survival time and event censoring and survival function and hazard functions.	Ap
CO -3	Learn how to select and apply appropriate scaling and scoring metrics, how to create an analysis plan and how to present survey findings in useful tables and charts.	Ay
CO -4	To design a good qualitative purpose statement and a good central question in qualitative research	E
CO -5	To create scientific knowledge, to integrate ideas into a solution, to propose an action plan, to formulate a new classification scheme	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Text Book and Reference

Gupta. S.P, Statistical Methods , Sultan Chand & Sons, New Delhi.

Question Paper Pattern

Maximum Marks:75Exam 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.Sc., Statistics Code : S4PSTEL4C

(For students admitted from 2018 onwards)

EC 4 - R - PROGRAMMING

Credits : 4 Hours / Week : 6

Course Objectives:

1. To introduced basic concepts of R program in statistical tools. To enable students to use R program for data processing.
2. To learn the statistical analysis using 'R' free and open source software.

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

Course Outcomes

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand basics of R environment.	Un
CO -2	Able to work with R packages and their installation	Ap
CO -3	Demonstrate exploratory data analysis (EDA) for a given data set.	Ay
CO -4	Implement and assess relevance and effectiveness of machine learning algorithms for a given dataset.	E
CO -5	To provide the programming skills using job oriented concept in R program.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

Reference

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

Question Paper Pattern

Maximum Marks:75Exam 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.Sc., Statistics Code : S4PSTEL5A

(For students admitted from 2018 onwards)

EC 5 – ACTUARIAL STATISTICS

Credits: 4 Hours / Week: 6

Course Objectives:

1. To learn the life tables used in insurance products.
2. To learn the concept of interest, different life insurance products, life annuities, net premiums.
3. To motivate students to prepare for exams required for employment in the actuarial science profession.

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.

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	To gain the knowledge of the actuaries and an insurance industry. And obtain the financial field and medical immunization program analysis.	Un
CO -2	Understand the utility theory, insurance products and life tables.	Ap
CO -3	Understand the concept of interest.	Ay
CO -4	Understand the concept of life insurance and the existing insurance products of different insurance company.	E
CO -5	Know life annuities, net premium and net premium reserves.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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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:75Exam 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.Sc.,Statistics Code : S4PSTEL5B

(For students admitted from 2018 onwards)

EC 5 – STATISTICAL METHODS FOR EPIDEMIOLOGY

Credits: 4 Hours / Week: 6

Course Objectives:

1. The basic idea of various terminologies in epidemiology, clinical trial experiments involving different phases.
1. To learn and develop scientific view to study the statistical challenges of clinical comparison of two or more treatments in human subjects.
2. To Aware of the use of the cross-over design and its limitations.

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.

Course Outcomes:

At the end of the course the Students will be able to		Cognitive Level
CO -1	Design and analysis of epidemiological studies including case-control and cohort study designs.	Un
CO -2	Various data management and data collection systems for a good clinical trial practice,	Ap
CO -3	Sufficient practical knowledge by means of laboratory assignments on different types of real life data sets.	Ay
CO -4	Systematic representation of epidemiological data using statistical package. Calculation of effect association of disease using various measures.	E
CO -5	Calculation of test of significance of cross-over effects, treatments effects and sequence of treatment effects.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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:75Exam 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.Sc., Statistics Code: S4PSTEL5C

(For students admitted from 2018 onwards)

EC 5 – OFFICIAL STATISTICS

Credits : 4 Hours / Week: 6

Course Objectives:

1. To learn understanding of data analysis using statistics computational tools on problems of applied nature.
2. 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

Course Outcomes:

At the end of the course the Students will be able to		**Cognitive Level**
CO -1	Understand the concept of censoring, life distributions and ageing classes.	Un
CO -2	Explain test of exponentiality against nonparametric classes, two sample problems.	Ap
CO -3	Official Statistics **are** numerical information collected and used by the government and its agencies **to make decisions about society and the economy.**	Ay
CO -4	To learn Official Statistics are collected in the 'national interest' and so avoid the biases of private research, which would only collect data which would be of interest to the particular researcher, or data which is profitable.	E
CO -5	Students will be able to locate, apply and cite effective secondary data in their own skill.	Pr

Un –Understand, Ap- Application, E-Evaluate, Ay- Analysis, Pr-Practice

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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:75Exam 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**