SRI VENKATESWARA UNIVERSITY:: TIRUPATI

SVU COLLEGE OF SCIENCES

M.Sc., APPLIED STATISTICS

Syllabus for M.Sc. Applied Statistics

Choice Based Credit System (CBCS)

(w.e.f. the Academic Year 2019-2020)

VISION: To en-corporate certain specific objectives and scale to prepare the students to take up challenges in any one or more functional domain

1. ACADEMICS

2. BASIC AND APPLIED RESEARCH

3. RESEARCH AND DEVELOPMENT

4. SOFTWARE SKILLS

5. INDURSTRY

6. STATISTICAL ANALYSIS

MISSION: To bring out professional having knowledge of basic laws of nature together with strong fundamentals of in core areas of statistics viz. linear algebra, probability and distributions, statistical inference, multivariate analysis, econometric methods, operations research-i, time series analysis and forecasting methods , operations research-ii. Specializations subjects like….Sampling techniques, stochastic process, linear models and applied regression analysis, computer programming and data analysis, demography and official statistics, bio-statistics, statistical process and quality control, advanced econometric models. Technical subjects like… statistical analysis using excel and spss, python, design and analysis of experiments, industrial statistics and quality control, statistical analysis using R + R practical's

Program Educational Objectives: At the end program the student will be able to

- **PEO1:** Apply principals of basic scientific concepts in understanding and predictions of statistical sciences
- **PEO2:** Develop human resources with specializations in theoretical and experimental techniques required for carrier in academic, research and industry
- **PEO3:** Engage in lifelong learning and adopt changing in professional and society needs

PROGRAM EDUCATIONAL OBJECTIVES: at the program the student will be able to

- **P01:** Apply the scientific knowledge to solve the statistical data analysis problems
- **PO2:** Identify, formulate and analyze advanced scientific problems reading substantiated conclusions for all kind of disciplines like medical, biological series and so on.
- **PO3:** Creative design solutions for advanced scientific problems `and design system components using statistical analysis that meet the specified need with appropriate attention to health and safety risks.
- **PO4:** Using statistical analysis understanding the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
- **PO5:** Create, select and apply appropriate techniques, resources and modern statistical tools to complex statistical problems with understanding of the limitations.
- **PO6:** analyzing the impact of marketing sales into the society using data science techniques.
- **PO7:** By statistical methods demonstrating the knowledge and understanding the scientific principles and applying the statistical tools to manage projects and in multidisciplinary environments.
- **PO8:** apply ethical principles and norms of scientific practices
- **PO9:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings by statistical approach.
- **PO10:** Understanding the working of various analog communication techniques by using data science methods

- **PO11:** Project management of finance in collaboration with various firms by data science techniques
- **PO12:** Recognize the need and have the preparation and ability to engage independent and life-long learning in the broadest context of scientific and technological change by statistical approach.

Program Specific Outcomes: At the end of the program the student will be able to

- **PSO1:** Understand the basic and advanced concepts of probability, distributions.
- **PSO2:** Perform and design experiments in the area of Bio-statistics, advanced Bio-statistics, Time series
- **PSO3:** Apply knowledge on software like Excel, SPSS and R software

S.V. UNIVERSITY, TIRUPATI
DEPARTMENT OF STATISTICS
M.Sc., APPLIED STATISTICS
CBCS Pattern (With effect from 2019-20)
The course of Study and Scheme of Examinations

SEMESTER-I

Sl. No.	Course Code	Components of Study	Title of the Course	Cont act Hours	No. of Credits	IA Marks	End SEM Exam Marks	Total Marks
1	APST - 101	Core	Linear Algebra	6	4	20	80	100
2	APST - 102	Core	Probability Theory	6	4	20	80	100
3	APST - 103	Core	Distribution Theory	6	4	20	80	100
4	APST - 104	Core	Practical-I (75 Practical + 25 Record)	6	4	-	-	100
5	APST - 105	Compulsory Foundation **(Related to Subject)**	Statistical Computing	6	4	20	80	100
6	APST - 106	Elective Foundation	Human Values and Professional Ethics-I	6	4	20	80	100
	Total			**36**	**24**			**600**

SEMESTER-II

Sl. No.	Course Code	Components of Study	Title of the Course	Cont act Hours	No. of Credits	IA Marks	End SEM Exam Marks	Total Marks
1	APST - 201	Core	Statistical Inference	6	4	20	80	100
2	APST - 202	Core	Multivariate Analysis	6	4	20	80	100
3	APST - 203	Core	(a) Linear Models and Applied Regression Analysis (b) Stochastic Processes (c) Mathematical Analysis	6	4	20	80	100
4	APST - 204	Core	Practical-II(75 Practical +15 Viva- voce + 10 Record)	6	4	-	-	100
5	APST - 205	Compulsory Foundation **(Related to Subject)**	Sampling Techniques	6	4	20	80	100
6	APST - 206	Elective Foundation	Human Values and Professional Ethics-II	6	4	20	80	100
	Total			**36**	**24**			**600**

SEMESTER-III

Sl. No.	Course Code	Components of Study	Title of the Course	Contact Hours	No. of Credits	IA Marks	End SEM Exam Marks	Total Marks
1	APST - 301	Core	Applied Econometrics	6	4	20	80	100
2	APST - 302	Core	Experimental Designs and Applications	6	4	20	80	100
3	APST -303	Core	Applied Operations Research	6	4	20	80	100
4	APST -304	Core	Practical-III (75 Practical +25 Record)	6	4	-	-	100
5	APST - 305	Generic Elective* **(Related to Subject)**	(a) Advanced Bio-Statistics (b) Computer Programming and Data Analysis (c) Data Mining and Information Security	6	4	20	80	100
6	APST - 306	Open Elective **(For other Department)**	(a) Statistics for Biological and Earth Sciences (b) Statistics for Social and Behavioral Sciences	6	4	20	80	100
	Total			**36**	**24**			**600**

*** Among the Generic Electives the student shall choose ONE**

SEMESTER-IV

Sl. No.	Course Code	Components of Study	Title of the Course	Contact Hours	No. of Credits	IA Marks	End SEM Exam Marks	Total Marks
1	APST - 401	Core	Applied Forecasting Methods	6	4	20	80	100
2	APST - 402	Core	Applied Demography and Official Statistics	6	4	20	80	100
3	APST - 403	Core	Reliability and Survival Analysis	6	4	20	80	100
4	APST - 404	Core	Practical-IV (75 Practical + 15 Viva-voce + 10 Record)	6	4	-	-	100
5	APST - 405	Generic Elective* **(Related to Subject)**	(a) Statistical Quality Control (b) Statistics for Research, industry and Community Development (c)Actuarial Statistics	6	4	20	80	100
6	APST - 406	Open Elective **(For other Department)**	(a) Statistics for Marketing Research (b) Statistical Analysis Using SPSS	6	4	20	80	100
	Total			**36**	**24**			**600**

*** Among the Generic Electives the student shall choose ONE**

SEMESTER – I

APST 101: LINEAR ALGEBRA

Unit-I: Algebra of matrices; Elementary transformations; Rank and Inverse of a matrix; Nullity; Partitioned matrices; Kronecker product; Generalized inverse of matrix; Moore-Penrose generalized inverse; Solutions of simultaneous equations.

Unit-II: Finite dimensional Vector Spaces; Vector Spaces and Subspaces; Linear dependence and independence; Basis and dimension of a vector space; Completion theorem; Inner product Spaces; Orthonormal basis and Gram-Schmidt orthogonalization process; Orthogonal projection of a vector.

Unit-III: Linear transformations and properties; Orthogonal and unitary transformations; Real quadratic forms; Reduction and classification of quadratic forms; Hermitian forms; Sylvesters law of inertia; Canonical reduction of quadratic form.

Unit-IV: Characteristic roots and vectors; Cayley – Hamilton theorem; Minimal polynomial; Similar matrices; Spectral decomposition of a real symmetric matrix; Reduction of a pair of real symmetric matrices; Hermitian matrices.

References

1. Graybill, F.A. (1983). Matrices with applications in statistics, 2nd ed. Wadsworth, Belmont (California).
2. Rao, C. R. (1985). Linear statistical inference and its applications, Wiley Eastern Ltd., New Delhi.
3. Searle, S. R. (1982). Matrix Algebra useful for Statistics, John Wiley and Sons. Inc.
4. Bellman, R. (1970), Introduction to Matrix Analysis, 2nd ed. McGraw Hill, New York.
5. Campbell, H.G. (1980), Linear Algebra with Applications, 2nd Edition, Prentice-Hall, Englewood Cliffs (new Jersey), 1980.
1. Biswas, S. (1984), Topics in Algebra of Matrices, Academic Publications.
2. Hadley, G. (1987), Linear Algebra, Narosa Publishing House.
3. Halmos, P.R. (1958), Finite-dimensional Vector Spaces 2nd ed. D.Van Nostrand Company, Inc.
4. Hoffman, K. and Kunze, R, (1971). Linear Algebra, 2nd ed., Prentice Hall

5. Rao, A.R. and Bhimasankaram, P. (1992), Linear Algebra, Tata McGraw Hill Publishing Company Ltd.
6. Rao, C.R. and Mitra, S.K. (1971), Generalized Inverse of Matrices and its Applications, John Wiley and Sons, Inc.
7. Narayan, S. (1970), Theory of Matrices, S. Chand &Company, New Delhi.

Subject Code	Subject Name	Credits Allotted		Total
APST-101	**Linear Algebra**	Theory	Practical	4
		4	---	
Course Objective	1. To Prepare Students about algebra of matrices and vector spaces. 2. To explain about roots vectors and linear transformations with an examples 3.To give the knowledge of orthogonality and its properties. 4. To know about the canonical form and its reduction			
Course Out comes	1. Students understood for estimation of elementary transformations in matrix and their solutions. 2. Students learnt about characteristic roots and vectors with numerical examples. They also know theoretical proofs of theorems. 3. Discriminate between diagonalizable and non-diagonalizable matrices; orthogonally diagonalizable symmetric matrices and quadratic forms 4. Combine methods of matrix algebra to compose the change-of-basis matrix with respect to two bases of a vector space, identify linear transformations of finite dimensional vector spaces and compose their matrices in specific bases			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**1**				**3**	**2**	**2**	**2**
CO2	**3**	**2**	**3**	**2**	**1**				**3**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**1**				**3**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**2**	**1**				**3**	**2**	**2**	**2**

APST 102: PROBABILITY THEORY

Unit-I: Classes of sets, fields, σ -fields, minimal σ -field, Borel σ – field in R^K, sequence of sets, limsup and liminf of a sequence of sets. Measure, Probability measure, properties of a measure, Caratheodory extension theorem (statement only), Lebesgue and Lebesgue-Stieltjes measures on R^K.

Unit-II: Measurable functions, Random variables, sequence of random variables, almost sure convergence, convergence in probability (and in measure). Integration of a measurable function with respect to a measure, Monotone convergence theorem, Fatou's lemma, Dominated convergence theorem.

Unit-III: Expectation of a random variable, inequalities on expectations, Markov, Holder, Jensen and Liapiunov inequalities. Borel- Cantelli - Lemma, Independence, Weak law and strong law of large numbers for iid sequences, Chebyshev's theorem, khinchine's theorem, Kolmogorov theorems (statements only).

Unit-IV: Convergence in distribution, theorem (statement only), CLT for a sequence of independent random variables under characteristic function, uniqueness theorem, CLT for iid random variables, Lindberg-Levy Central limit theorem; Liapounov theorem (statements only).

References

1. Ash, Robert. (1972). Real Analysis and Probability. Academic Press.
2. Billingsley, P. (P. (1986) Probability and Measure. Wiley.
3. Dudley, R.M. (1989). Real Analysis and Probability, Wadsworth and Brooks/Cole.
4. Kingman, J F C and Taylor, S. J. (1966). Introduction to Measure and Probability. Cambridge University Press.
5. Loeve, M (1963), Probability theory
6. Bhatt B.R (1998), Modern Probability theory, Wiley Eastern
7. Mukhopadhyay, P.(2002), Mathematical Statistics, Books& Allied (p) Ltd., Kolkata.

Subject Code	Subject Name	Credits Allotted		Total
APST-102	**Probability Theory**	Theory	Practical	4
		4	---	
Course Objective	1. To Explain about classes of sets and Probability measures 2. To discuss on random variables and convergence in probability and			

	the important theorems with proofs. 3. To discuss about inequalities on expectations with their derivations and laws of numbers.
Course Out comes	1. Students must have knowledge about random variables, expectations, sets and their properties and inequalities where ever necessary. 2. Students also know the weak law, strong law and central limit theorem and their importance. 3. Students get the knowledge of the Central limit theorem and their real life uses. 4. Students can get the knowledge of the inequalities of probability and their uses.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**
CO2	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**
CO3	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**
CO4	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**

APST 103: DISTRIBUTION THEORY

Unit-I: Brief review of basic distribution theory, joint, marginal and conditional p.m. functions and p.d. functions. Rectangular, lognormal, exponential, gamma, beta, Cauchy, Laplace and Weibull distributions. Functions of random variables and their distributions using Jacobian of transformations and other tools.

Unit-II: Sampling distributions: central Chi Square, t and F distributions and its properties, applications, relation between t and F, F and χ^2; Fisher's Z-distribution, fisher's Z-transformation. Non-central chi-square, t and F distributions and their properties.

Unit-III: Order statistics and their distributions, joint and marginal distributions of order statistics, distribution of range. Extreme values and their asymptotic distributions.

Unit-IV: Multiple and partial correlation coefficients, multiple linear regression, inter relationship among partial and multiple correlation and regression coefficients. Null distributions of simple, partial and multiple correlation coefficients. Compound binomial distribution and compound Poisson distribution.

References:

1. Dudewicz E.J and Mishra S.N (1988): Modern Mathematical Statistics, Wiley, International Students Edition.
2. Rohatgi V.K. (1984): An Introduction to probability theory and mathematical statistics.
3. Rao C.R (1973): Linear Statistical Inference and its Applications, 2/e, Wiley Eastern.
4. Pitman J. (1993): Probability, Narosa Publishing House.
5. Johnson, N.L and Kotz, S.M. (1972): Distributions in Statistics, Vol. I , II & III. Houghton and Miffin.
6. Yule, U and M.G. Kendall: An introduction to the theory of Statistics.
7. David H.A (1981): Order Statistics, II Edition, and John Wiley.
8. Feller W (1966): Introduction to probability theory and its applications, Vol. III, second edition. Wiley Eastern.
9. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics. Sulthan and Chand Company.
10. Mukhopadhyay, P(2002), Mathematical Statistics, Books and Allied (p) Ltd., Kolkata.

Subject Code	Subject Name	Credits Allotted		Total
APST-103	**Distributions Theory**	Theory	Practical	4
		4	---	
Course Objective	1. To explain about different discrete and continuous distributions and their properties. 2. To learn about derivations and properties of various sampling distributions. 3. To explain order Statistics and their properties			
Course Out comes	1. Students know about different continuous and discrete distributions and their properties. 2. They have awareness about central and non-central sampling distributions and order Statistics. Idea about simple, partial and multiple correlation coefficients. 3. Students get the knowledge of the statistical Tests and their real life uses and applications. 4. Students get the knowledge of Regression and Correlations and their real-life applications.			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**
CO2	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**
CO3	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**
CO4	**3**	**2**	**1**	**1**	**1**				**1**		**2**	**3**

APST 104 : PRACTICAL-I

At least 20 practicals covering all papers relating to the subject in this semester must be carried out. (75 marks for practical examination + 25 marks for record in the semester)

Subject Code	Subject Name	Credits Allotted		Total
APST-104	**PRACTICALS**	Theory	Practical	4
		----	4	
Course Objective	1. To write different problems manually solving through calculators. 2. To write problems and solving them on computers using Statistical software like Excel and other relevant software etc., 3. To make the students to apply the statistical techniques in the Real life. 4. To know the statistical analysis using R software			
Course Out comes	1. Numerical problems related to, Linear Algebra and Sampling Techniques are solved by executing programs of computers. 2. Linear algebra concepts when working with data preparation, such as one hot encoding and dimensionality reduction. 3. Applying linear algebra problems in real life situations. 4. Perform sampling methods analysis using R-software.			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**2**	**2**	**2**			**2**	**3**	**1**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**2**			**2**	**3**	**1**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**2**			**2**	**3**	**1**	**2**
CO4	**3**	**3**	**3**	**2**	**2**	**2**			**2**	**3**	**1**	**2**

APST 105: STATISTICAL COMPUTING

Unit-I: Programming in C: Identifiers and Key words, data types and their declaration. Data input and output, operators and expressions. Control statements, if, if-else, case, go to statements. Loops, while, do-while and for statements. One and two-dimensional arrays. Concept of structures, Unions and pointers. Simple programs.

Unit-II: Structure of C++ program, Concept of OOP, tokens, key words, data types, dynamic initialization, manipulators, operator overloading. Function prototyping, inline functions, friend function and virtual functions with examples. Data binding using class, creating objects, defining member functions with simple examples. The concept of inheritance and polymorphism. Dynamic memory allocation and processing of linked lists.

Unit-III: Review of Excel, sorting, filtering and construction of charts. Curve fitting and interpretation of the output. Statistical functions in Excel - Calculating theoretical probability using Binomial, Poisson and Normal distributions. Matrix operations- Transpose, Product and Inverse operations using Excel. Pivot tables and look up functions.

Unit-IV: Data bases using MS-Access – working with tables and forms. Various types of queries – make table, update, crosstab and delete quires and their SQL code. Creating reports using Access. Crystal reports tool - standard and cross tab reports using Access and Excel data. Group expert, sort expert, select expert and section expert. Running totals and formulas. Simple statistical charts like Bar graph and Pie Diagrams.

References

1. Balaguruswamy, E (2007), Programming in ANSI C, 4E, Tata Publishing McGraw-Hill Publishing Ltd.
2. Balaguruswamy, E (1998), Object Oriented Programming with C++, Tata Publishing McGraw-Hill Publishing Ltd.
3. Ravi Chandran. D (2002), Programminig with C++, Tata Publishing McGraw-Hill Publishing Ltd.
4. Sarma K.V.S. (2010), Statistics Made Simple Do it Yourself on PC, Prentice Hall.

Subject Code	Subject Name	Credits Allotted		Total
APST-105	**Statistical Computing**	Theory	Practical	4
		4	----	
Course Objective	1. To familiar and to develop learning mindsets to analyze statistical data through C software. 2. To learn basic syntax, coding and vocabulary to aid in data analysis. 3. To give the students a real life practice on analysis. 4. To have a clear idea about the operations in excel			
Course Out comes	1. Students get the basic Programming Skills of C and C++. 2. Students learnt how the Data entre in the Excel with Headings. 3. Students get the knowledge of creating data ase using the MS-Access. 4. Students get the knowledge how to create the reports using MS-EXCEL and MS ACCESS.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**3**	**1**			**1**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**	**1**			**1**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**2**	**3**	**1**			**1**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**3**	**1**			**1**	**2**	**3**	**3**

APST 106: HUMAN VALUES AND PROFESSIONAL ETHICS-I

UNIT-I: Definition and Nature of Ethics-Its relation to Religion ,Politics, Business, Legal ,Medical And Environment ,Need And Impleme ntation Ethics-Goals-Ethical Values in Various Professions.

UNIT-II: Nature Of Values-Good and Bad, Ends and Means, Actual and Potential Values, Objectives and Subjective Values ,Analysis Of Basic Moral Concepts-rights, Ought, Duty, Obligation, Justice. Responsibility and Freedom. Good Behavior and Respect for Elders, Character and Conduct.

UNIT-III: Ahimsa (Non-Violence), Satya (Truth),Brahmacharya (Celibacy),Asteya (Non-possession) and APARIGRAHA (Non-stealing).Purusharthas (Cardinal virtues)-Dharma (Righteousness), Artha (Wealth), Kama(Fulfillment bodily desires).Moksha (Liberation)

UNIT-IV: Bhagavad Gita-(a) Niskama karma.(b).Buddhism-The four noble truths-Arya Astanga marga, (c) Jainisam- mahavratas and anuvratas. Values embedded in various religions, Religious tolerance, Gandhian ethics.

UNIT-V: Crime and Theories or punishment-(a) Reformative , Retributive and Deterrent ,(b) Views on manu and Yajnavalkya.

References:

1. R.Subramanian ,Professional Ethics, Oxford University Press.
2. Joha S Mackenjie:A Manual Of Ethics.
3. The Ethics of Management by Larue Tone Hosmer.Richard D.Irwin Lnc.
4. Management Ethics Integrity at Work by Joseph A.Petrick and John F.Quinn.Respons Books;New Delhi.
5. “Ethics in Management” By S.A.Sherlekar, Himalaya Publication House.
6. Harold H.Titus ; Ethics For Today.
7. Maitra,S.K;Hindu Ethics.
8. William Lilly;Introducation Ethics.
9. Sinha: A Manual of Ethics.
10. Manu:Manava Dharma Sastra or the Institute of Manu:Comparising the Indian Syastem of Duties :Raligious and civil (ed.) G.C.Halighton.
11. Susrpta samh ita: Tr.Kaviraj Kunjanlal , Kunjalal Brishagratha .Chowkarnaba Sanskrit series. Vol LII and III , Varanasi , Vol I 00, 16’20,21-32 and 74-77 only.
12. Caraka samhita :Tr.Dr.Ram karan sarma and vaidya bhagavan dash, Chowkarnaba Sanskrit series office. Varanasi I,11.111 Vol IPP 183-191.
13. Ethics, Theory and contemporary issues.Barbara mackinnon wadsworth / Thomsaon learning, 2001.
14. Analyzing moral.issues,Judith A.Boss.May Field Publishing Company-1999.
15. An introduction to applied ethics(ed.)John H.Piet and Ayodhya Prasad.cosmo publications.
16. Text book for intermediate first year ethics and human values. Board of intermediate education-Telugu-academy, Hyderabad.
17. I.C.Sharma ethics philosophy of india.Nagin & co julundhar.

Course Objectives:

1. Students need get the awareness of the Human Values and Ethics.
2. Students need to get the knowledge of the value education.
3. To teach the students how to behave in society.
4. To have a clear idea about the theme of bagavatgita.

Course Outcomes:

1. Students get the knowledge of the Ethical values.
2. Students get the idea about the Value education.
3. Students learn how to behave in Society.
4. Students get the knowledge of the Bhagavat Geetha and Can apply in their life's.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				**3**		**3**	**3**	**3**	**3**	**2**		**3**
CO2				**3**		**3**	**3**	**3**	**3**	**2**		**3**
CO3				**3**		**3**	**3**	**3**	**3**	**2**		**3**
CO4				**3**		**3**	**3**	**3**	**3**	**2**		**3**

SEMESTER – II

APST 201: STATISTICAL INFERENCE

Unit-I: Point estimation - Unbiasedness, Consistency, Efficiency and Sufficiency; Fisher-Neyman factorization theorem, complete sufficient statistics, minimum variance unbiased estimator (MVUE), Cramer - Rao inequality, Battacharayas inequality, Rao – Blackwell theorem. Exponential family, Maximum Likelihood estimation method, method of moments, method of minimum chi-squares and interval estimation.

Unit-II: Tests of hypothesis: Basic concepts, Most Powerful (MP) test, Neyman – Pearson Lemma, Consistency and Unbiased tests, Uniformly Most Powerful (UMP) test, UMP Unbiased tests, similar critical regions, Lehmann –Scheffe theorem, Likelihood Ratio Tests, Asymptotic Distribution of LR test, Bartlett's test for homogeneity of variances and Wald Test.

Unit-III: Non – Parametric tests of significance; Sign Test, Wilcoxon-Mann-Whitney U-test, Run test, Kolmogorov-Simrnov one and two sample tests, Median test, Kendall's τ test. Concept of asymptotic relative efficiency, CAN, BAN, CAUN and BEST CAUN estimators, MLE in Pitman family and Double Exponential distribution, MLE in Censored Truncated distribution.

Unit-IV: Statistical decision theory – decision problems and two person games, problems of inference viewed as decision problems, non-randomized and randomized decision rules, Loss and Risk functions, admissibility, complete and essentially complete class, complete class theorem. Bayes principle, determination of Bayes rule Minimax principle, determination of minimax rule, minimax theorem. Minimax estimates of parameters of Binomial, Poisson and Normal distributions.

References

1. Rohtagi, V.K (1988): An Introduction to Probability and Mathematical Statistics, Wiley Eastern
2. Rao C.R (1973), Linear Statistical Inference and its applications, (Revised Edition), Wiley Eastern
3. Lehmann, E.L (1986), Theory of point estimation, (Student Edition)
4. Lehmann, E.L (1986), Testing Statistical Hypothesis (Student Edition)
5. Gibbons, J.D (1985), Non-parametric statistical inference, 2nd Edition, Mercel Dacker Inc

6. Siegal Sidney (1987), Non-parametric Statistics for behavioral sciences, 3rd Edition, Springer Verlog
7. Kendal, M.G and Stuart, A (1968), The advanced theory of statistics, Vol-II, Chales Griffin and Co., London
8. Ferguson, T.S (1967), Mathematical Statistics – a decision theoretic approach, Academic Press
9. Goon, A.M, Gupta, M and Das Gupta, B (1980), An outline of statistical theory, Vol-II, World Press, Calcutta.

Subject Code	Subject Name	Credits Allotted		Total
APST 201	**STATISTICAL INFERENCE**	Theory	Practical	4
		4	----	
Course Objective	1. To study the Estimation methods of point and their different measures and theorems, inequality. 2. To discuss about Testing of hypothesis that contains NP Lemma, UHP test, Bartlett's, Wald test, LR test and some theorems relates to hypothesis testing. 3. To discuss different non-parametric tests with examples. Asymptotic relative efficiency and truncated distributions. 4. To study the Game theory and their problems, minimax rule, minimax theorem and minimum estimates of parameters using different distributions.			
Course Out comes	1. Students know about point estimation, non-parametric models, Game theory, theorems and Proofs where ever necessary. 2. They can understand the concept of random sample from a distribution, sampling distribution of statistic, standard error of important estimates such as mean and proportions. 3. Students may gain the knowledge of testing of hypotheses (both large sample test and small sample test). 4. They can also calculate the problems related to point estimation and interval estimation.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**2**	**1**				**1**		**1**	**2**
CO2	**3**	**2**	**2**	**2**	**1**				**1**		**1**	**2**
CO3	**3**	**2**	**2**	**2**	**1**				**1**		**1**	**2**
CO4	**3**	**2**	**2**	**2**	**1**				**1**		**1**	**2**

APST 202: MULTIVARIATE ANALYSIS

Unit-I: Multivariate normal distribution, marginal and conditional distributions, characteristics functions, Maximum likelihood estimators of parameters, distribution of sample mean vector and dispersion matrix, distribution of quadratic form in the exponent of the multivariate normal density.

Unit-II: Hotelling's T^2 and its applications – T^2 distribution, application of T^2 to single sample, two sample and multiple sample problems, optimum properties of T^2 test. Mahalobis D^2 statistic and its distribution, Multivariate Analysis of Variance (MANOVA) of one and two-way classified data.

Unit-III: Classification and discrimination: procedures for classification into two multivariate normal populations, Fisher's Discriminant function, classification into more than two multivariate normal populations, Wishart distribution and its properties, concept of sample generalized variance and its distribution.

Unit-IV: Principal Component Analysis – properties, method of extraction of principal components; Canonical variables and canonical correlations; Factor Analysis – mathematical model, estimation of factor loading, concept of factor rotation; Cluster Analysis – similarities and dissimilarities, Hierarchical clustering: single and complete linkage method.

References

1. Anderson, T.W (1983), An introduction to Multivariate Statistical Analysis, Wiley, 2nd Edition.
2. Rao, C.R (1973), Linear Statistical Inference and its applications, 2nd edition, Wiley
3. Srivastava. M.S and Khatri, C.G (1979), An introduction to Multivariate Statistics, North Holland
4. Morrison,F(1985): Multivariate Statistical Methods, Mc Graw Hill Book Company.
5. Johnson A.R and Wishern, D.W (1996), Applied Multivariate Statistical Analysis, Prentice Hall of India
6. Sharma, S (1996), Applied Multivariate Techniques, Wiley
7. Krishisagar, A.M (1972), Multivariate Analysis, Marcel Dekker
8. K.C. Bhuyan(2005): Multivariate Analysis and its Applications, Central.

Subject Code	Subject Name	Credits Allotted		Total
APST 202	**Multivariate analysis**	Theory	Practical	4
		4	----	
Course Objective	1. To study about Multivariate normal distributions and their properties, it's importance. 2. To discuss Hotelling's T^2, Mahalanobis D^2 statistic and its applications and properties. 3. To explain MANOVA with one and two way classified data. 4. To discuss about Principal Component Analysis, Factor Analysis and Cluster Analysis with appropriate methods.			
Course Out comes	1. Students learnt about importance of multivariate variables and their distributions 2. T^2, D^2, MANOVA models are understood and know it's importance. 3. Implement dimension reduction techniques using software on real life problems. 4. Classification analysis methods explained according to their classification algorithm.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**1**	**3**	**1**			**2**		**1**	**1**
CO2	**3**	**3**	**2**	**1**	**3**	**1**			**2**		**1**	**1**
CO3	**3**	**3**	**2**	**1**	**3**	**1**			**2**		**1**	**1**
CO4	**3**	**3**	**2**	**1**	**3**	**1**			**2**		**1**	**1**

APST 203(a): LINEAR MODELS AND APPLIED REGRESSION ANALYSIS

Unit-I: Two and Three variable Linear Regression models; General linear model: Assumptions; OLS estimation; BLUE; Tests of significance of individual regression coefficients; Testing the equality between two regressions coefficients; Test of significance of complete regression.

Unit-II: Criteria for model selection; Goodness of fit measures; R^2 and adjusted R^2 Criteria; C_p criterion; testing the general linear hypothesis; Chow test for Equality between

sets of regression coefficients in two linear models; test for structural change; restricted least squares estimation; Generalized Mean Squared error criterion.

Unit-III: Non-normal disturbances and their consequences; test for normality; Jarque-Bera test; Shapiro-Wilk test, Minimum Absolute Deviation (MAD) estimation; Box-Cox transformations.
Statistical analysis of residuals, OLS residuals, BLUS residual, Studentised residual, Predicted residual, tests against heteroscadasticity.

Unit-IV: Non-Linear regression; Non linear least squares estimation; Maximum Likehood estimation; Idea of computational methods; Gradient methods, Steepest descent method and Newton-raphson method; testing general Nonlinear hypothesis; Wald test, Lagrange multiplier test and likelihood ratio Test. Robust , probit, binomial logistic ,multiple logistic regression.

References

1. Johnston, J (1984): Econometric Methods, III rd edition. MC Graw Hill.
2. Gujarathi, D (1979): Basic Econometrics, MC Graw Hill.
3. Judge, C.G., Griffiths, R.C.Hill, W.E ., Lutkephol, H and Lee, T.C (1985): The Theory and Practice of Econometrics, John Wiley and Sons.
4. Draper, N and Smith, B (1981): Applied Regression Analysis, Second Edition

Subject Code	Subject Name	Credits Allotted		Total
ST 203(a)	**Linear models and Applied Regression Analysis**	Theory	Practical	4
		4	----	
Course Objective	1. To discuss about linear regression models and their assumptions. 2. To study about different criteria for model selection and their Goodness of fit measures. 3. To explain Non normal disturbances and their consequences and statistical analysis of residuals. 4. To discuss about Non-linear regression estimation methods.			
Course Out comes	1. Students learnt about different linear and non-linear regression models and their appropriate computational procedures. 2. They know R^2, adjusted R^2 and C_p criteria for model selection. 3. They will get the knowledge of building and fitting linear regression models with software. 4. They also learn about the theory underlying point estimation,hypothesis and confidence intervals for linear			

	regression models.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**2**	**2**	**1**			**2**		**1**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**1**			**2**		**1**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**1**			**2**		**1**	**2**
CO4	**3**	**3**	**3**	**2**	**2**	**1**			**2**		**1**	**2**

APST 203(b): STOCHASTIC PROCESSES

Unit-I: Introduction to stochastic processes (sp's): classification of sp's according to state apace and time domain. Countable state Markov chains (MC's), Chapman – Kolmogorov equations, calculation of n – step transition probability and its limit. Stationary distribution, classification of states,, transient MC, random walk and gambler's ruin problem.

Unit-II: Discrete state space continuous time MC: Kolmogorov – Feller differential equations, Poisson process, birth and death process; Applications to queues and storage problems. Wiener process as a limit of random walk, first – passage time and other problems.

Unit-III: Renewal theory: Elementary renewal theorem and applications. Statement and uses of key renewal theorem, study of residual life time process: weakly stationary and strongly stationary process; Moving averages and auto regressive process.

Unit-IV: Branching process: Galton – Watson branching process, probability of ultimate extinction, distribution of population size. Martingale in discrete time, inequality, convergence and smoothing properties. Statistical inference in MC and Markov process.

References

1. Adke, S.R and Manjunath, S.M (1984): An Introduction to Finite Markov Processes, Wiley Eastern.
2. Bhat, B.R (2000): stochastic Models: Analysis and Applications, New Age International, India.
3. Cinlar, E (1975): Introduction to Stochastic Processes, Prentice Hall.

4. Feller, W (1968): Introduction to Probability and its Applications, Vol. 1, Wiley Eastern.
5. Harris, T.E (1963): The Theory of Branching Processes, Springer – Verlag.
6. Hoel, P.G., Port, S.C and Stone, J.C (1972): Introduction to Stochastic Processes, Houghton Miffin & Co.
7. Jagers, P (1974): Branching Process with Biological Applications, Wiley.
8. Karlin, S and Taylor, H.M (1975): A First Course in Stochastic Processes, Vol. 1, and Academic Press.
9. Medhi, J (1982): Stochastic Processes, Wiley Eastern.
10. Parzen, E (1962): Stochastic Processes, Holden – Day.

Subject Code	Subject Name	Credits Allotted		Total
ST 203 (b)	**STOCHASTIC PROCESSES**	Theory	Practical	4
		4	----	
Course Objective	1. To learn and to understand stochastic process predictive approach. 2. To develop an ability to analyze and apply some basic stochastic process for solving real life situations. 3. To knowa about stochastic process and their importance, Markov chains, Poisson process, Renewal theory, Branching process etc. 4. To explain the concept of the Moving Averages and its applications...			
Course Out comes	1. Understand the stochastic processes, Markov chains, Transition probability matrix and various types of states. 2. Explain Random walk, Gambler ruins problem and apply Poisson process in real life situations. 3. Formulate and solve problems which involve setting up stochastic models. 4. Understand renewal theory and branching processes with applications.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**1**				**1**	**1**	**2**	**1**
CO2	**3**	**2**	**1**	**1**	**1**				**1**	**1**	**2**	**1**
CO3	**3**	**2**	**1**	**1**	**1**				**1**	**1**	**2**	**1**
CO4	**3**	**2**	**1**	**1**	**1**				**1**	**1**	**2**	**1**

APST 203(c): MATHEMATICAL ANALYSIS

Unit-I: Real numbers; Bounded and unbounded Sets; Supremum and Infimum; Completeness in R; Open and closed sets; Countable sets; Bolzano-weierstrass theorem; Heine-Borel theorem, Uniform continuity.

Unit-II: Sequences: convergence of sequences; limits, inferior and superior; Cauchy sequences; Sandwich theorem; uniform convergence of sequences. Series: convergence of series; comparison tests for series. uniform convergence of series, Power series.

Unit-I11: Reimann Integration; mean value theorems of integral calculus; concepts of Reimann-Stieltjes integral and Improper integrals; Double and Triple integrals; Gamma and Beta integrals.

Unit-IV: Review of complex number systems, analytic functions and their properties, complex integration, Cauchy's theorem, integral formula, Taylor's and Laurant's series, singularities, residues, Cauchy residue theorem.

References

1. Malik,S.C. (1985), Mathematical Analysis (Second Edition); New Age International Pvt. Limited, New Delhi.
2. Apostol, T. M. (1985), Mathematical Analysis, Narosa Publishers, New Delhi.
3. Narayan, S.(1985) , A course of Mathematical Analysis, S.Chand & Company, New Delhi.
4. Royden, H.L.(1988), Real Analysis, 3rd Edition, MacMillan, New York.
5. Rudin Walter (1976), Principles of Mathematical Analysis, 3rd Edition, McGraw Hill, New York.
6. Chaudhary B (1983): The elements of complex analysis, Wiley Eastern.
7. Curtiss J.H (1978): Introduction to the functions of complex variables, Marcel Dekker.

Subject Code	Subject Name	Credits Allotted		Total
APST 203 (c)	**MATHEMATICAL ANALYSIS**	Theory	Practical	4
		4	----	
Course Objective	1. Students get the knowledge of real no.'s and set theory. 2. Students get the knowledge of the sequencing.			
Course Out comes	1. Students get the knowledge of real no.'s and set theory and their theories. 2. Students easily earn the knowledge of the sequencing theory.			

	3. Students get the knowledge if the integrations and their applications in the real life. 4. Students get the knowledge of the complex no. system and their applications I the statistics.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO2	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO4	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**

APST 204: PRACTICAL –II

At least 20 practicals covering all papers relating to the subject in this semester must be carried out. (75 marks for practical examination + 15 marks for viva-voce + 10 marks for record in the semester)

Subject Code	Subject Name	Credits Allotted		Total
APST-204	**PRACTICALS**	Theory	Practical	4
		----	4	
Course Objective	1. To exercise different practical problems manually through calculators. 2. To discuss problems relates to semester - II papers.			
Course Out comes	1. Students know about the solving of Numerical problems related to Multivariate data. 2. Students can learn how the Statistical tests uses in their real life's by doing the tests on the Real times Data. 3. They can also use the statistical tools and techniques for analyzing the statistical data. 4. Students can solve the agriculture related problems using the Regression Methods.			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO2	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO4	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**

APST 205: SAMPLING TECHNIQUES

Unit-I: Review of basic concepts of sampling theory such as sampling design, sampling scheme, sampling strategy etc., Sampling with varying probability with and without replacement, PPS WR/WOR methods – Lahiri's sample scheme, Hansen – Hurwitz, Des Raj estimators for a general sample size and Murthy estimator for a sample of size 2, Symmentrized Des Raj estimator.

Unit-II: Hurwitz – Thompson estimator (HTE) of a finite population total / mean, expression for V(HTE) and its unbiased estimator. IPPS scheme of a sampling due to Midzuno – Sen and JNK Rao (sample size 2 only). Rao – Hartley-Cochran sampling scheme for a sample of size n with random grouping.

Unit-III: Ratio and Regression methods of estimation, Two stage sampling, Multi stage sampling, Cluster sampling. Resampling methods and its applications.

Unit-IV: Double sampling for difference, ratio, regression and PPS estimators; Large scale sample surveys, Errors in surveys, A mathematical model for errors of measurement, Sampling and Non-sampling errors, Sources and types of non-sampling errors, Remedies for non-sampling errors.

References

1. Chaudhuri. A and Mukerji. R (1988): Randomized Response Theory and Techniques, New Yory, Marcel Dekker Inc.
2. Cochran W.G (1988): Sampling Techniques III Edition (1977) Wiley.
3. Des Raj and Chandak (1988): Sampling Theory. Narosa.
4. Murthy M.N (1977): Sampling Theory and Methods. Statistical Publishing Society.
5. Sukhatme et al (1984): Sampling Theory of Surveys with Applications. Iowa State University Press & IARS
6. Sing D and Chudary F.S (1986): Theory and Analysis of Sample Survey Designs. New Age International Publishers.
7. Hedayat A.S and Sinha B.K. (1991): Design and Inference in Finite Population Sampling. Wiley.
8. Mukhopadhyay P(1996): Inferential problems in Survey Sampling. New Age International.
9. Wolter K.M (1985): Introduction to Variance Estimator. Springer. Verlag.
10. Hansen M.M and Hurwitz W.M and Mandow W.G (1954): Sample Survey Methods and Theory, Vol. I and Methods and Applications Vol. II, John Wiley and Sons.
11. Philli. I. Good (2013):Introduction to statistics through resampling methods and R, 2nd edition.

Subject Code	Subject Name	Credits Allotted		Total
APST-205	**Sampling Techniques**	Theory	Practical	4
		4	----	
Course Objective	1. Discuss about basic concepts of sampling techniques PPS WR/WOR models. 2. To study about Hurwitz Thompson estimator, PPS scheme. 3. To learn about Ratio and Regression methods and their properties. 4. To explain Double sampling for difference estimators using ratio regression and PPS's, Non sampling error and their remedies.			
Course Out comes	1. Students learnt different sampling techniques of with replacement/ without replacement and Different sampling models. 2. Students studied non-Sampling errors and different remedies. 3. Implement Cluster sampling, Ratio and Regression estimation in real life problems 4. Apply unequal probability sampling designs viz. PPSWR, PPSWOR including Lahiri's method and Murthy's estimator for survey.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**3**	**3**	**1**			**2**		**2**	**2**

CO2	**3**	**2**	**1**	**3**	**3**	**1**			**2**		**2**	**2**
CO3	**3**	**2**	**1**	**3**	**3**	**1**			**2**		**2**	**2**
CO4	**3**	**2**	**1**	**3**	**3**	**1**			**2**		**2**	**2**

APST 206: HUMAN VALUES AND PROFESSIONAL ETHICS-II

UNIT-I: Value Education –Definition-Relevance to present day-Concept of Human Values-self introduction-self-esteem-family values-Components , Structure and responsibilities of family-Neutralization of anger-Adjustability-Threats of family life –Status of women in family and society –Caring for need elderly –Time allotment for sharing ideas and concerns.

UNIT-II: Medical ethics-Views if charaka, Sushruta and Hippocratus on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia ,ethical obligation to animals, ethical issues in relation to health care professional patients. Social justice in health care , human cloning , problems of abortion .Ethical issues ingenetic engineering and ethics issues raised by new biological technology of knowledge.

UNIT-III: Business ethics – Ethical standards of business-immoral and illegal practices and their solutions. Characteristics of ethical problems in management, ethical theories causes of unethical behavior , ethical abuses and work ethics.

UNIT-IV: Environmental Ethics- Ethical Theory , man And Nature- Ecological Crisis , Pest Control , Pollution and Waste , Climate Change, Energy and Population, Justice and Environmental Health.

UNIT-V: Social ethics – Organ trade. Human trafficking, Human rights violation and social disparities, Feminist ethics. Surrogacy / pregnancy, Ethics of media-Impact of newspapers, Television , Movies and Internet.

References:

1. Joha S Mackenjie:A Manual Of Ethics.
2. The Ethics of Management by Larue Tone Hosmer.Richard D.Irwin Lnc.
3. Management Ethics Integrity at Work by Joseph A.Petrick and John F.Quinn.Respons Books;New Delhi.
4. “Ethics in Management” By S.A.Sherlekar, Himalaya Publication House.
5. Harold H.Titus ; Ethics For Today.
6. Maitra,S.K;Hindu Ethics.
7. William Lilly;Introducation Ethics.

8. Sinha: A Manual of Ethics.
9. Manu:Manava Dharma Sastra or the Institute of Manu:Comparising the Indian Syastem of Duties :Raligious and civil (ed.) G.C.Halighton.
10. Susrpta samh ita: Tr.Kaviraj Kunjanlal , Kunjalal Brishagratha .Chowkarnaba Sanskrit series. Vol LII and III , Varanasi , Vol I 00, 16'20,21-32 and 74-77 only.
11. Caraka samhita :Tr.Dr.Ram karan sarma and vaidya bhagavan dash, Chowkarnaba Sanskrit series office. Varanasi I,11.111 Vol IPP 183-191.
12. Ethics, Theory and contemporary issues.Barbara mackinnon wadsworth / Thomsaon learning, 2001.
13. Analyzing moral.issues,Judith A.Boss.May Field Publishing Company-1999.
14. An introduction to applied ethics(ed.)John H.Piet and Ayodhya Prasad.cosmo publications.
15. Text book for intermediate first year ethics and human values. Board of intermediate education-Telugu-academy, Hyderabad.
16. I.C.Sharma ethics philosophy of india.Nagin & co julundhar.
17. I.C.Sharma ethics philosophy of india.Nagin & co julundhra.

Course Objectives:

1. Students need to get the knowledge of the Responsibilities.
2. Students need to get the awareness of the Medical Ethics.
3. To know about the environment ethics.
4. To have a clear idea about the human rights.

Course Outcomes:

1. Students get the Knowledge of Status of Women in the family and society.
2. Students get the idea of the Medical Rights and Their responsibilities in the medical practitioners.
3. Students get the idea about the environmental Ethics.
4. Students Get the knowledge of Human Rights.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				**3**		**3**	**3**	**3**	**3**	**2**		**3**
CO2				**3**		**3**	**3**	**3**	**3**	**2**		**3**
CO3				**3**		**3**	**3**	**3**	**3**	**2**		**3**
CO4				**3**		**3**	**3**	**3**	**3**	**2**		**3**

SEMESTER – III

APST 301: APPLIED ECONOMETRICS

Unit-I: Quick review of inference in classical linear regression model; Estimation and tests of significance of linear and compound growth rates; Incremental analysis; Testing the function form of regression; choosing between linear and log-linear regression models; Likelihood Ratio, Wald and Lagrange Multiplier tests.

Unit-II: Multicollinearity; Sources, consequences and detection of Multicollinearityl Farrar-Glauber test; remedial measures; Heteroscedasticity: Sources and consequences; Tests for Heteroscedasticity; Glejser's test, Goldfield-Quandt test and Breusch-Pagan-Godfrey test; Estimation of parameters under Heteroscedasticity;

Unit-III: Autocorrelation; sources and consequences; first order autoregressive scheme; tests for autocorrelation Durbin-Watson test; Remedies; Estimation of parameters under Autocorrelation; Stochastic Regressors; Errors in variables linear model, IV and ML methods of estimation.

Unit-IV: Finite distributed lag models; Almon's Polynomial approach; Infinite distributed lag models; Geometric lag model; Koyck's approach; IV method; simultaneous linear equations models; Problem of identification; Indirect least squares, LIML, Two stage least squares; three stage least squares and FIML estimation methods.

References:

1. Johnston, J (1984): Econometric Methods, III rd edition , MC Graw Hill.
2. Judge, C.G., Griffths, and Hill, R.C. et al (1985): Theory and Practice of Econometrics, John Wiley.
3. Gujarathi, D. (1979): Basic Econometrics, Mc Graw hill.

4. Intrilligator, M.D (1980): Econometric Models, Techniques and Applications, Prentice Hall.

Subject Code	Subject Name	Credits Allotted		Total
APST-301	**APPLIED ECONOMETRICS**	Theory	Practical	4
		4	----	
Course Objective	1. To explain about heteroscedasticity, multicollinearity and their sources, consequences and tests. 2. To discuss about Autocorrelation, different orders of Autocorrelation and their estimation procedures. 3. To explain different lag models and their estimate procedures. 4. To discuss about simultaneous linear equations model and their different methods and estimation.			
Course Out comes	1. Students learnt heteroscedasticity, multicollinearity and autocorrelation and their estimation procedures. 2. Students understood about different lag models and simultaneous linear equations model with their estimation methods. 3. Explain core concepts and techniques in econometrics, with a special focus on the classical linear regression model. 4. Understand the assumptions upon which different econometric methods are based and their implications.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO2	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO3	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO4	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**

APST 302: EXPERIMENTAL DESIGNS AND APPLICATIONS

Unit-I: Standard linear model, BLUE, Gauss-Markoff theorem, ANOVA for one way, two way and three way classifications (with equal number of replications per cell). Multiple Range Tests-LSD test, Student-Newman-Keuls test; Duncan's Multiple Range test, Tukey's test; Multiple F-tests, Scheffe's test; Tukey's Gap, Straggler and Variance test;

Unit-II: Transformation of data; Square Root, Arc Sine and Logarithmic transformations; Test for additively of data. Latin squares, Orthogonal Latin Squares and their construction, Missing Plot Technique for Latin Square Design, Graeco and Hyper Graeco Latin Square Designs.

Unit-III: Factorial experiments; analysis of 2^n, 3^2 and 3^3 factorial designs in randomized blocks. Concept of complete and partial confounding. Confounding in 2^n, 3^2 and 3^3 factorial designs and their analysis.

Unit-IV: Fractional factorial designs, design resolution, alias pattern, construction of half and one-fourth fractions of 2^n designs and analysis. Response surface designs- first and second order rotatable designs and central composite designs. Concept of orthogonal arrays and linear graphs with applications to process control.

References

1. Montgomery, D.C (1976), Design and Analysis of Experiments, John Wiley and Sons
2. Chakraborthy, M.C (1962), Mathematics of Design and Analysis of experiments, Asia Publishing House, Bombay.
3. Kempthorne, O (1965), Design and Analysis of Experiments, Wiley Eastern
4. Das, M.N and N.C. Giri (1979), Design and Analysis of Experiments, Wiley Eastern
5. Federer, w.T (1963), Experimental Design, Theory and Application, MacMillian Company, New York
6. Joshi, D.D (1987), Linear Estimation and Design of Experiments, Wiley Eastern
7. Winner, B.J (1971), Statistical Principles in Experimental Design, 2nd edition, Mc Graw Hill, Inc
8. Pearce, S.C (1984), Design of Experiments, Wiley

Subject Code	Subject Name	Credits Allotted		Total
ST 302	**EXPERIMENTAL DESIGNS AND APPLICATIONS**	Theory	Practical	4
		4	----	
Course				

Objective	1. To learn ANOVA and ANCOVA for one- and two-way classifications analysis and their multiple comparison tests. 2. To explain Latin squares, different types of Latin squares and their missing plots. 3. To discuss on Confounding, their types, confounding 2^n, 3^2 and 3^3 factorial designs etc. 4. To discuss about BIBD, PBIBD construction analysis.
Course Out comes	1. Students learnt ANOVA, ANCOVA technique for one way and two-way classifications. Multiple comparisons tests using Tukey's, Duncans, Sheffe's and Dunnet's tests. 2. Students understood about Latin squares and their construction, missing plot technique etc. 3. Students explained about Incomplete Block Designs and their analysis, etc. 4. Understand the basic terms used in design of experiments by using appropriate experimental methods.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO2	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO3	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO4	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**

APST 303: APPLIED OPERATIONS RESEARCH

Unit-I: Definition and scope of Operations research; phases in Operations Research; models and their solutions (Review of Linear Programming). Definition of Dual-Primal, Relationships- Dual Simplex Sensitivity or Post Optimal Analysis, Revised Simplex method.

Unit-I1: Non-linear programming - Kuhn Tucker conditions. Wolfe's algorithm for solving quadratic programming problems. Integer programming – Branch and bound algorithm and cutting plane algorithm.

Unit-III: Flows in networks max-flow-min-cut theorem. Project Management; PERT and CPM probability of project completion, PERT – crashing. Decision making in the face of competition, two-person games, pure and mixed strategies, existence of solution and uniqueness of value in zero- sum games, finding solution in 2x2, and 2xm, and mxn games.

Unit-IV: Queuing models-specifications and effectiveness measures. Steady state solutions of M/M/1 and M/M/c models with associated distributions of queue length and waiting time. M/G/1 Queue and Pollazcek Khinchine result. Steady-state solutions of M/Ek/1 and Ek/M/1 queues. Bulk queues.

References

1. Taha H.A (1982) Operational Research: An Introduction; Macmillan.
2. Hiller F. Sand Leiberman G.J. (1962) Introduction to Operations Research; Holden Day
3. Kanti Swarup; Gupta P.K and Singh M.M (1985) Operations Research; Sultan Chand.
4. Philips D.T, Ravindran A and Solberg J Operations Research, Principles and Practice.
5. Curchman C.W; Ackoff R.L and Arnoff E.L(1957) introduction to Operations Research; John Wiley
6. Hadley G (1964) Non-Linear and Dynamic programming Addison Weslay.
7. Mckinsey J.C.C(1952) Introduction to the theory of games Mc Graw Hill.P.K.Gupta; D.S.Hira Operations Research S.CHand.

Subject Code	Subject Name	Credits Allotted		Total
APST-303	**APPLIED OPERATIONS RESEARCH**	Theory	Practical	4
		4	----	
Course Objective	1. To introduce operations research, Dual-primal, Revised simplex methods. 2. To discuss Non-linear programming and integer programming and their related problems. 3. To explain Network flow charts, CPM and PERT, project management models. 4. To discuss Game theory of 2×2, 2×m, m×n and non-zero-sum games with their illustrations.			

Course Out comes	1. Students understood about Dual primal, Revised simplex methods. 2. Students learnt non-linear programming, integer programming, CPM, PERT, different models of games. 3. Students can think the real-life problems in the way of Linear Programming Problems and try to solve the problems in Mathematical Way. 4. Students can take a decision in real life by Using the Game Theory Techniques.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO2	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO3	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**
CO4	**3**	**2**	**1**	**2**	**3**	**1**			**1**		**2**	**2**

APST 304 : PRACTICAL-III

At least 20 practicals covering all papers relating to the subject in this semester must be carried out. (75 marks for practical examination + 25 marks for record in the semester)

Subject Code	Subject Name	Credits Allotted		Total
APST-304	**PRACTICAL**	Theory	Practical	4
		----	4	
Course Objective	1. To solve the different practical problems manually through calculators and computers. 2. To do the Practical problems related to semester - III papers.			
Course Out comes	1. Students can understand the Statical Methos in Economical Views. 2. Students solved the Numerical problems related to operations research. 3. Students Understand the Life Tables in Demography. 4. Students can understand how the statistics use in biological aspects. .			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO2	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO3	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**
CO4	**3**	**3**	**2**	**3**	**3**				**2**	**2**	**3**	**1**

APST 305 (a): ADVANCED BIOSTATISTICS

Unit-I: Structure of Biological assay, Direct assays, Potency ratio, Feller's theorem and its generalization. Quantitative dose-response relationships, Linear dose-response regression, Parallel line bioassay, Slope Ratio Bioassay, Quantal responses, estimation of median effective dose, Transformations: Probit and Logit transformations.

Unit-II:: Basic Biological concepts: Gene, Chromosomes, Alleles, Concepts of Geno types and Phenotypes, Family studies, Basic mating from single gene cross, Matrix approach to basic matings of single gene cross, Checker board method, Mendal's law of heredity: Geneotypes and Pheno type ratios, Branching system method.

Unit-III: Types of matings, Random Mating, Concept of Gene pool, Gene frequency, Hardy–Weinberg law of equilibrium, Calculation of Gene frequencies, Genotypic frequency, Generation matrix approach to inbreeding, Estimation of Gene frequencies in ABO blood group system, Maximum Likelihood Method, Minimum Chi-Square method, Genetic parameters; Heritability Coefficients, Genetic Correlations, Repeatability, selection index; Inbreeding coefficient.

Unit-IV: Statistical Methods in Clinical Trials- phase I, II, III and IV trails. Statistical design for clinical trials- fixed sample trials. Simple randomized design, stratified randomized design, crossover and sequential designs – open and close sequential design. Dynamic randomization, Permuted block randomization; Single, double and triple blinding methods.

References

1. D.J. Finney (1971): Statistical Methods in Biological Assay, Charles Griffen and Company, London.

2. D.J. Finney (1971): Probit Analysis, 3rd Edition, S.Chand and Company Ltd, New Delhi.
3. William D. Stansfield. (1969): Theory and Problems of Genetics, Schaum's Outline Series, MC Graw Hill, New York.
4. Oscar Kempthorne (1973): An Introduction to Genetic Statistics, Jagmohan Book agency, New Delhi.
5. J.P. Jain (1992): Statistical Techniques in Quantitative Genetics, 2nd Edition, Hindustan Publishing House, New Delhi.
6. Basu, S. B. (1996), Quantitative Genitics Research Technique, Kalyani Publishers, New Delhi.
7. Elisa T. Lee &John Wenyu Wang (2003): Statistical methods for Survival Data analysis, 3rd Edition, John Wiley
8. Jerrold H. Zar (1999): Biostatistical Analysis, 4th edition, Pearson.
9. Armitage, P, Berry G and Mathews J.N.S. (2002): Statistical Methods in Medical Research, 4/e, Blockwell Scientific Publications.
10. Rastogi. V.B. (2006), Fundamental of Biostatistics. ANE Books, India.

Subject Code	Subject Name	Credits Allotted		Total
		Theory	Practical	
APST 305(a)	**ADVANCED BIOSTATISTICS**	4	----	4
Course Objective	1. To understand about biological assay and their types, distribution and some of theorems. 2. To learn dose response relationships, their estimation, transformations. 3. To discuss Geno types and phenol types, Matrix operations to base mattings of single gen cross etc. 4. To estimate Gene frequency using different methods.			
Course Out comes	1. Students learnt about biological assay, their distribution and theorems, dose response relationships, basic concepts of biological assay, estimation methods of gene frequencies, etc. 2. Describe single and multi-species population growth models. 3. Apply the concept of deterministic and stochastic models on simple and general epidemics. 4. Understand linearization of dynamical systems with various dimensions.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

CO1	**3**	**3**	**2**	**1**	**2**	**1**			**2**		**2**	**3**
CO2	**3**	**3**	**2**	**1**	**2**	**1**			**2**		**2**	**3**
CO3	**3**	**3**	**2**	**1**	**2**	**1**			**2**		**2**	**3**
CO4	**3**	**3**	**2**	**1**	**2**	**1**			**2**		**2**	**3**

APST 305(b): COMPUTER PROGRAMMING AND DATA ANALYSIS

Unit-I: Essentials of R-language – Expressions and objects, assignments, creating vectors, vectorized arithmetic, creating matrices, operations on matrices, lists, data frame creation, indexing, sorting and conditional selection with examples. Programming using conditional statements and loops, data editor, reading data from text files.

Unit-II: Obtaining summary statistics, generating tables, bar plots, pie charts, box plots, histograms. Random sampling from discrete and continuous distributions, plotting density and cumulative density curves, Q-Q plots with suitable examples.

Unit-III: Data Analysis Pak in Excel, descriptive statistics, tests of hypothesis, ANOVA, Correlation and Regression, Random Number Generation from different distributions, Binomial, Poisson, Uniform, Normal and from discrete distributions with given mean and variance. Forecasting Using Excel – Moving Averages and Exponential Smoothing, Use of functions, Linest, Logest, Forecast , Growth, Trend for trend analysis. The use of solver for optimization – Application to LPP.

Unit-IV: Data handling using SPSS: Opening Excel files in SPSS. Merging of files, selection of records, recoding. Analysis tools, descriptive statistics, cross tabs (with stress on procedures and syntax). Post-hoc analysis for multiple comparisons using Tukey's test, Duncan's Multiple Range Test, Dunnet's test and Scheffe's test with interpretation. Selection of variables in Multiple Linear Regression – stepwise procedures and analysis of residuals. Procedure for Binary Logistic regression, Factor analysis, Linear Discriminant analysis and Cluster analysis.

References

1. Introductory Statistics with R by Peter Dalgaard, Springer, 2nd editions, 2008
2. The R book by Micheal J. Crawley, John Wiley and Sons, Ltd, 2007
3. Sarma, K.V.S (2010), Statistics Made Simple, Do it Yourself on PC, Prentice Hall of India.
4. Johnson and Wichern, Multivariate Analysis, Prentice Hall

Course Outcomes:

1: UnderstandtheatomictypesofR, differentmethodsofcreatingandfilteringof vectors,manipulationoftextdata,factordataanddates.
2: Understandhowtocreate,subsetandmodifydatastructureslikematrices, arrays,dataframesandlists.UnderstandhowtoreaddataintoandoutofR.
3: Understand the control statements of R, writing functions and scripts in R and debuggingfeatures ofR.Understandtheuseofapply familyoffunctions.
4: Understandtheusethehigh-levelplottingfunctionsinRtocreategraphsin baseRandthe low-levelplottingfunctionstocustomizethe graphs.
5: Understandtheuseofbuilt-infunctionstoperformhypothesestesting, correlationandregressionanalysis,andANOVA.

Course objectives:

1. Able to create and manipulate vectors, matrices, arrays, data frames and lists.
2. Should be able to work with character data, factor data and dates.
3. Able to write scripts and function in Rand read data from. csvfiles, EXCEL files And SPSS files.
4. Abletodistinguishbetweenhigh-levelandlow-levelplottingfunctionsavailable in base R.
5. Abletousebuilt-infunctionstoanswerquestionsrelatingtoprobability

distributions, parametric and non-parametric hypothesis testing, correlation and regression analysis, and one-way and two-way ANOVA.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**	**1**			**2**	**1**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**3**	**1**			**2**	**1**	**2**	**1**
CO3	**3**	**3**	**3**	**3**	**3**	**1**			**2**	**1**	**2**	**1**
CO4	**3**	**3**	**3**	**3**	**3**	**1**			**2**	**1**	**2**	**1**

APST 305 (c): DATA MINING AND INFORMATION SECURITY

UNIT-I: Data warehousing components: Introduction, Access tools, Data Marts, Data Mining data warehousing, Industry, Methodology. Classical Techniques, Statistics, Neighborhoods, clustering, The classics, Nearest Neighbor, Tree Network and Rules, Neural Network – Rule Induction.

UNIT-II: Basic Data Mining Taks, classification, regression, time series analysis, prediction, clustering, summarization, association rules, sequence discovery. Data mining versus knowledge discovery in data bases. The development of data mining issues. Data mining metrics, social implications of data mining, data mining from a data base perspective. Exploratory Data Analysis.

UNIT-III: Security Trends-The OSI architecture-Security Attacks-Security Services – Security Mechanisms- A Model for Network Security Classical Encryption Techniques, Symmetric Cipher Model, Substitution Techniques Transportation Techniques, Rotor Machines –Steganography. Public-Key Encryption and Hash Functions Introduction to Number Theory Prime Numbers – Fermat's and Euler's Theorems, Testing for Primality – The Chinese Remainder Theorem, Discrete Logarithms.

UNIT-IV: Public-key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm, Digital Signatures and Authentication Protocols**:** Digital Signatures, Authentication Protocols-Digital Signature Standard Authentication Applications **:** Kerberos-X.509 Authentication Service, Public Key Infrastructure .

References

1. Margaret H. Dunham (2006), Data Mining – Introductory and Advanced Topics, Pearson Education.
2. Tukey, (1997), Exploratory Data Analysis
3. Cleveland, (1993), Visualizing Data

4. Tufte, (1983), Visual Display of Quantitative Information Anything on statistics by Jacob Cohen or Paul Meehl.

5. Cryptography and Network Security Principles and Practices – Fourth Edition –By William Stallings- Pearson Prentice Hall Publishers.

APST 306 (a): STATISTICS FOR BIOLOGICAL AND EARTH SCIENCES

Unit - I: Statistical measures: Statistical diagrams and graphs; Frequency distributions; Measures of central tendency: Arithmetic mean, Median and Mode; Measures of variation: Range, Quartile Deviation, Mean Deviation, Standard deviation, Coefficient of variation; Karl Pearson's coefficient of Skewness.

Unit- II : Random Variable and Probability Distributions: Definition of Probability, Additive and Multiplicative laws of probability (statements only), Random variable, Binomial, Poisson, Normal and Exponential distributions (properties and applications), Curve Fitting: Principle of least squares; Fitting of a straight line, Exponential curve and Power curve; Correlation and Regression Analysis: Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient; Simple linear regression; Multiple and Partial correlation coefficients; Multiple linear regression; Yules coefficient of Association.

Unit –III: Tests of Significance: Basic concepts; Z- test for proportions and means; Applications of t, χ^2 and F tests; Paired t-test; Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA) techniques for one way and two way classifications (single observation per cell), Confidence limits.

Unit- IV: Special Statistical Tools: Experimental designs CRD, RBD and LSD and their analysis; concept of critical difference; Duncan's Multiple range test; Elements of Principal components Analysis, Factor Analysis; Cluster Analysis and Discriminant analysis; Hotelling's T^2 and Mahalanobis D^2 statistics; Multivariate Analysis of Variance (MANOVA); Canonical correlations; Concept of Probit analysis.

References

1. Bailey, N.T.J.(1959), Statistical Methods in Biology, The English Universities Press Ltd.,
2. Pillai, S.K., and Sinha, H.C.(1968), Statistical Methods for Biological workers, Ram Prasad and sons, Agra.
3. Basu, S.P.(1996), Quantitative Genetics Research techniques, Kalyani publishers, New Delhi.
4. Misra, B.N., and Misra, M.K.(1998), Introductory Practical Biostatistics, Naya Prakash, Kolkata.
5. Johnson, R.A., and Wichern, D.W.(2001), Applied Multivariate Statistical Analysia, Third edition, Prentice Hall of India, New Delhi.
6. Federer, W.T.(1969), Experimental Designs and its appliucations.

Subject Code	Subject Name	Credits Allotted		Total
APST 306 (a)	**Statistics for Biological and Earth sciences**	Theory	Practical	4
		4	----	
Course Objective	1. 2. To learn basic statistics and their worked out examples. 3. To discuss about different tests like t, F, χ^2 and Z fro means, proportions, variances, standard deviation etc. with illustrations. 4. To explain ANOVA and ANCOVA for one way and two way classification and their importance in analysis. 5. To discuss Special statistical tools and multivariate analysis.			
Course Out comes	1. Students learnt about Graphs, measures of averages, measures of dispersion etc. 2. Students understood about Basic probability and important distributions with workout examples. 3. Students used t, F, χ^2 , ANOVA and ANCOVA and non-parametric tests with examples. 4. Students used Advanced statistics tools with working illustrations.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**2**	**1**	**2**		**1**		**2**	**1**
CO2	**3**	**2**	**1**	**1**	**2**	**1**	**2**		**1**		**2**	**1**

CO3	**3**	**2**	**1**	**1**	**2**	**1**	**2**		**1**		**2**	**1**
CO4	**3**	**2**	**1**	**1**	**2**	**1**	**2**		**1**		**2**	**1**

APST 306 (b): STATISTICS FOR SOCIAL AND BEHAVIOURAL SCIENCES

Unit- I: Statistical Measures: Measures of central tendency: Arithmetic Mean, Median and Mode; Measures of Variation: Range, Quartile Deviation, Standard Deviation, Coefficient of Variation, Measures of Skewness.

Unit- II: Probability and Distributions: Concept of Probability, Laws of Probability (statements only); Random Variable; Probability Distributions: Binomial, Poisson and Normal distributions (properties and applications).

Unit- III: Tests of Significance: Basic concepts; Random sampling techniques; Standard error of statistic; Large sample tests for proportions and means; Small sample tests: Applications of t, χ^2 and F tests; Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA) techniques for one way and two way classifications (single observation per cell); Nonparametric tests: Wilcoxon Signed Rank test, Median test and Mann-Whitney U-test.

Unit- IV: Special statistical tools: Computation of Linear and Compound Growth rates and their tests of significance; Chow test for Structural change; Granger Causality test; Stepwise regression; R^2 and $\overline{R}^2$ statistics; Multiple Range tests: LSD. test and Duncan's test: ANOVA for Ranked data; Krushkal-wallis test, Friedman test; Elements of Factor analysis and Discriminant analysis.

References

1. Gupta, S.C.(1997), Fundamentals of Statistics, Himalayan Publishers, Mumbai.
2. Kshirasagar, A.M. (1972), Multivariate Analysis, Marcel Decker, New York.
3. Gujarati, D.(1995), Basic Econometrics, Mc Graw Hill.
4. Ferguson, C.A.(1971), Statistical Analysis in Psychology and Education, McGraw Hill.

5. Johnson, R.A., and Wichern, D.W. (2001), Applied Multivariate Statistical Analysis, Third Edition, Prentice-Hall of India (p) Ltd.,. New Delhi.

Subject Code	Subject Name	Credits Allotted		Total
APST 306 (b)	**Statistics for social and behavioral sciences**	Theory	Practical	4
		4	----	
Course Objective	1. To learn about Basic statistics measures with examples. 2. To discuss important concepts, probability distributions like Binomial, Poisson and Normal properties and applications. 3. To explain Parametric and non-parametric test and discussed with illustrations. 4. To discuss advanced statistical tools with examples.			
Course Out comes	1. Students learnt about Graphs, measures of averages, measures of dispersion etc. 2. Students understood about basic probability and important distributions with workout examples. 3. Students applied t, F, χ^2, ANOVA and ANCOVA and non-parametric tests and discussed with examples. 4. Students used Advanced statistics tools with illustrations.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**2**	**1**	**2**	**1**			**1**		**2**	**2**
CO2	**3**	**1**	**2**	**1**	**2**	**1**			**1**		**2**	**2**
CO3	**3**	**1**	**2**	**1**	**2**	**1**			**1**		**2**	**2**
CO4	**3**	**1**	**2**	**1**	**2**	**1**			**1**		**2**	**2**

SEMESTER – IV

APST 401: APPLIED FORECASTING METHODS

Unit-I: Need and uses of forecasting, classification and characteristics of forecasts, forecasting based on regression techniques: simple and multiple linear regression and non-linear regression techniques, moving averages smoothing methods: simple and double, multi average methods; explanatory version time series forecasting, test for trend seasonality.

Unit-II: Exponential smoothing methods: trend adjusted exponential smoothing, double and triple exponential smoothing, winten's method, Chow's adaptive control methods, brown's one parameter adaptive method: Box-Jenkins three parameter smoothing, Harrison's Harmonic smoothing methods, tracking signal.

Unit-III: Auto regressive series, yules series, markoff series, deseasonalisting and detrending an observed time series, auto-covariance, Auto Correlation Function(ACF),Partial Auto Correlation Function(PACF) and their properties, conditions for stationary and invertibility. Period gram and correlogram analysis.

Unit-IV: Box-Jenkin's time series methods: Moving average , Autoregressive , ARMA and AR integrated MA (ARIMA) models, estimation of ARIMA model parameters, forecasting with ARIMA models, Diagnostic checking of the model: Analysis of residuals, forecasting using transfer function model, concept of Kalmon's Filters relation for outline.

References

1. Thomopouls, N.T (1980): Applied Forecasting Methods. Engle Wood Cliffs, N.J, Prentice Hall.
2. Wheel Wishart, S.C; and S. Makridaks (1980): Forecasting Methods for Management . III edition, New York. John Wiley.
3. Sullivan, William G. and Wayne Claycambe. W (1977): Fundamentals of Forecasting. Prentice Hall. Virginia.

4. Gupta. S.C and V.K. Kapoor (1995): Fundamentals of Applied Statistics, Sulthan & Chand Sons. New Delhi.
5. Bovas, Abraham and Johannes Ledolter (1983): Statistical Methods for Forecasting, John Wiley & Sons. New York.
6. Box, G.E.P and Jenkkins, G.M (1976): Time Series Analysis Forecasting and Control, Holden Day, San Francisco.
7. Anderson, T.W (1971): The Statistical Analysis of Time Series, John Wiley, New York.
8. Markidakis, S Steven C. Wheel Wright and Victor E. Mcgee (1983): Forecasting: Methods and Applications, 2nd Edition, New York, John Wiley & Sons.

Subject Code	Subject Name	Credits Allotted		Total
APST 401:	**APPLIED FORECASTING METHODS**	Theory	Practical	4
		4	----	
Course Objective	1. To fit growth curves, measurement of cyclical and irregular component with simple examples. 2. To discuss Forecasting and their techniques like regression, non-linear regression, exponential smoothing, etc. 3. To explain Box Jenkins time series models and their estimation of parameters, fitting and diagnostic checking.			
Course Out comes	1. Students understood Time series analysis with some important growth models and their fitting 2. Students forecasting using regression, non-linear regression techniques, single, double, triple and adoptive exponential smoothing models. 3. Students obtained knowledge on AR, MA, ARMA, ARIMA, models fitting, diagnostic checking, etc. 4. Check and validate models with its residual analysis and diagnostic checking.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO2	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO3	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO4	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**

APST 402: APPLIED DEMOGRAPHY AND OFFICIAL STATISTICS

Unit-I: Indian and International Statistical Systems, Functions of CSO and NSSO; Organization of large scale sample surveys; Data dissemination systems. Non-Governmental statistical organizations, Methods of conducting population census and Economic census in India. Indian population census.

Unit-II: Official Statistics and their limitations; Methods of collection of official statistics; System of collection of Agricultural Statistics, Crop forecasting and estimation; Agricultural census in India defects; Statistics related to Forests, Fisheries; Trade, Labour, Finance, Price and Industries; CMI, SSMI and ASI publications.

Unit-III: Definition, Scope and limitations of demographic analysis; Sources of Demographic data in India; Mortality measures, Construction of life tables; Abridged life tables; Measures of fertility and Reproduction.

Unit-IV: Methods for population projection, Use of Leslie matrix, Stable and Stationary populations; Lokta's model; Models for population growth and their fitting; Stochastic models for population growth; Concept of Migration and Urbanization, Chandrasekhar nand Demings method, Stochastic model for Birth and Deaths.

References

1. B.N. Gupta (1994), Statistics, Sathiya Bhawan, Agra.
2. B.L. Aggarwal (1994), Basic Statistics, general edition, Wiley eastern, New Delhi.
3. Asthana, B.N.(1970), Indian official Statistics.
4. S. Biswas (1988), Stochastic Process in Demography and Applications, Wiley Eastern, New Delhi.
5. K.B. Pathak and F. Ram (1992), Techniques of Demographic Analysis, Himalayan Publishing House, Bombay.

Subject Code	Subject Name	Credits Allotted		Total
APST 402:	**APPLIED DEMOGRAPHY AND OFFICIAL STATISTICS**	Theory	Practical	4
		4	----	
Course				

Objective	1. To study about demography and their importance, different reproduction. 2. To explain population Genetics, CSO, NSSO and their scope and contents in population census in India.
Course Out comes	1. Students know the growth rates, life tables, GRR, NRR and growth models. 2. Students understood about gene frequencies, genotypes, phenotypes etc. 3. Students learnt about population census methods, organizations in India and their functions. 4. Useful to students as a means of analyzing and predicting social, cultural, and economic trends related to population.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO2	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO3	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO4	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**

APST 403: RELIABILITY THEORY AND SURVIVAL ANALYSIS

Unit-I: Reliability: Concept and Measures of Reliability, bath tub curve, Reliability and failure density in terms of hazard rate; Hazard models, System Reliability Models: Reliability of Series and parallel systems, Mixed configuration models, Non-series-parallel systems; r-out of n- systems, Fault tree analysis.

Unit-II: Reliability improvement methods: Redundancy, element, unit and stand by redundancies; Maintainability and availability; Reliability allocation; Life testing and Reliability estimation; Exponential failure model, Normal, Gamma and weibull distributions and their applications in reliability estimation.

Unit-III: Functions of Survival time: Definitions, Relationships of Survival Functions; Non-parametric Methods of Estimating Survival Functions: Kaplan Meier Product limit Estimate; Non-parametric methods for comparing two survival distributions: Gehan's generalized

wilcoxon test, Cox-Mantel test, log rank test, Peto and peto's generalized wilcoxon test, Cox's F test and Mantel-Haenszel test.

Unit-IV: Graphical Methods for survival distributions fitting: Probability plotting, hazard plotting methods, testing of goodness of fit; Analytical Estimation Procedures for Survival distributions: Exponential, Weibull, Lognormal and Gamma Distributions only; Regression method for fitting Survival distributions; Parametric methods for comparing two survival distributions: Exponential, Weibull and Gamma Distributions only; Non-parametric and Parametric methods for identification of Prognostic factor relating survival time

References

1. L.S. Srinath (1998): Reliability Engineering, Applied East west Press PVT Ltd., New Delhi.
2. E. Balaguruswamy (1984): Reliability Engineering, Tata MC Graw Hill publishing company, New Delhi.
3. S.K. Sinha and B.K. Kale (1980): Life Testing and reliability Estimation, Wiley Eastern Ltd, New Delhi.
4. S.K. Sinha (1986): Reliability and Life Testing, Wiley Eastern Ltd, New Delhi.
5. Elisa T.Lee (1992), Statistical methods for survival data analysis, John Wiley sons.
6. Miller, R.G (1981), Survival Analysis, John Wiley
7. Cross A.J and Clark, V.A (1975), Survival distribution, reliability applications in the biomedical sciences, John Wiley and sons.
8. Elandt Johnson, R.E., Johnson, N.L.,(1999), Survival Models and Data Analysis, John Wiley and sons

Subject Code	Subject Name	Credits Allotted		Total
		Theory	Practical	
APST403	**RELIABILITY AND SURVIVAL ANALYSIS**	4	----	4
Course Objective	1. To discuss about reliability and their measures, analysis mixed configuration, series and parallel systems with examples. 2. To explain Redundancy for unit, element and stand by with simple applications. 3. To discuss Distributions for life testing and reliability estimation with their applications. 4. To understand Survival functions, survival distributions and fittings.			
Course Out comes	1. Students learnt about and survival analysis with their related distributions, relationships, non-parametric methods for computing survival analysis. 2. Estimate nonparametric survival function of the data. 3. Explain test of exponentiality against nonparametric classes, two sample problems. 4. Understand the elements of reliability, hazard function and its applications.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

CO1	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO2	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO3	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**
CO4	**3**	**1**	**1**	**1**	**2**				**2**		**3**	**3**

APST 404 :PRACTICALS -IV

At least 20 practicals covering all papers relating to the subject in this semester must be carried out. (75 marks for practical examination + 15 marks for viva-voce + 10 marks for record in the semester)

Subject Code	Subject Name	Credits Allotted		Total
APST-304	**PRACTICAL**	Theory	Practical	4
		----	4	
Course Objective	1. To solve the different practical problems manually through calculators and computers. 2. To do the Practical problems related to semester - IV papers.			
Course Out comes	1. Students can understand the Statical Methos in Economical Views. 2. Students solved the Numerical problems related to operations research. 3. Students get the knowledge od dynamic programming problems. 4. Students can understand how the statistics use in biological aspects. .			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**2**			**3**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**2**			**3**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**			**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**			**3**	**2**	**3**	**2**

APST 405 (a): STATISTICAL QUALITY CONTROL

Unit-I: Basic concepts of quality, causes of variation, principle of Shewart's control chart, control charts for attributes and variables. Control limits and probability limits. Process monitoring and control, process capability, modified control chart. Capability indices C_p, C_{pk}, and C_{pm}. Concept of Six sigma and its relationship with process capability.

Unit-II: The OC and ARL of Shewart's control charts. Control by gauging, Moving Average and Exponentially Weighted Moving Average charts. CUSUM charts using V-mask and decision interval methods. Multivariate control charts – Control Ellipsoid, Hotelling's T^2 chart.

Unit-III: Acceptance sampling plans for attribute inspection – Type-A and Type-B OC curves. Single, double and sequential sampling plans and their properties. Sampling plans with rectifying inspection-concept of AOQ, AOQL. Construction of Dodge CSP-1, CSP-2 and Multi level plans and their properties. Chain sampling and its applications. Design of Skip lot sampling plan and its ASN.

Unit-IV: Total Quality Management - Quality as a corporate strategy, six magnificent tools of process control, quality planning, costs of quality, analysis of quality costs, Zero Defects programme, quality circles, ISO 9000 and its modifications. Taguchi's contributions to Quality Engineering.

References

1. Montgomery D.C (2009), Introduction to Statistical Quality Control, 6/e, John Wiley and Sons, New York.
2. Edward G. Schilling, Dean V. Neubauer, (2009), Acceptance sampling in quality control Second Edition, Taylor & Francis.
3. Mittage, H.J and Rinne, H (1993): Statistical Methods of Quality Assurance, Chapmann Hall, London, UK.
4. Ott. E.R (1975), Process Quality Control, Mc Graw Hill
5. Phadke, M.S (1989), Quality Engineering through Robust Design, Prentice Hall
6. Duncan, A.J (1974), Quality Control and Industrial Statistics, 3rd Ed., New York, Irwin.
7. Philip J. Ross (1989), Taguchi techniques for quality engineering, McGraw Hill

Subject Code	Subject Name	Credits Allotted		Total
APST 405(a)	**Statistical Quality Control**	Theory	Practical	4
		4	----	
Course Objective	1. To discuss the basic concepts of control charts for variables and their indices. 2. To explain different control charts like Shewart's moving average, multivariate etc. with their applications. 3. To understand different sequential sampling plans and six sigma tool etc. with their properties and applications.			
Course Out comes	1. Students with their knowledge in control charts. 2. Students with their knowledge in Concept of Six sigma and its relationship with process capability. 3. Student have awareness about OC and ARL of Shewart's control charts 4. Students have awareness about Total Quality Management.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO2	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO3	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO4	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**

APST 405 (b): STATISTICS FOR RESEARCH, INDUSTRY AND COMMUNITY DEVELOPMENT

UNIT- I: Response Surface Designs: First and Second order Response Surface models; Rotatable designs; concept of connected design; outliers and Winsorized t - statistic; Stepwise regression; Specification of Random coefficients Regression model; Specification of variance components model; MINQUE Theory; Non parametric regression, the partially linear regression model.

UNIT-II: Simulation: Scope and limitations; Simulation models; Generation of RandomNumbers; Monte-Carlo simulation; Simulation of Queueing, Inventory Systems; Networks and Job sequencing.Data Envelopment Analysis (DEA): Non parametric approach

to productive efficiency; Input, output correspondences for Frontier production function; Mathematical Programming for productive efficiency: Farrell and Timmer approaches with reference to Cobb-Douglas production function.

UNIT-III: Demand Analysis: Laws of Demand and Supply; price and partial elasticities of demand; Pigous method for Time Series and Family Budget data; Engel's curve; Pareto law of Income distribution;Production Functions: Basic concepts; Isoquants; Cobb-Douglas, CES and Translog Production functions and their properties and estimation; Tools for Data Mining.

UNIT-IV: Social Surveys for Community Development: Objects, Types of Social Survey; Steps in social survey; Gallop polls; Prephology, Data collection; Kinds of measurement; Scaling methods: Thurstone, Likert and Guttman methods; Concepts of Validity and Reliability; Methods of calculating reliability coefficients; Test Reliability; ANOVA for Ranked data: Kruskal-Wallis and Friedman tests; Elements of cluster analysis, Factor analysis., path coefficient analysis and Discriminant analysis.

References

1. Das, M.N. and Giri, N.C. (1979), Design and Analysis for Experiments, Wiley Eastern (P) Ltd., New Delhi.
2. Montgomery, C.D. (1976), Design and Analysis of Experiments, Wiley & Sons, New York.
3. Johnston, J., and Dinardo, J. (1997), Econometric Methods, Fourth Edition, Mc Graw-Hill International Editions, New York.
4. Judge., C.G., et.al (1985), Theory and Practice of Econometrics, John Wiley.
5. Taha, H.A. (1992), Operations Research, An Introduction, Fourth Edition,

Subject Code	Subject Name	Credits Allotted		Total
405 (b)	**STATISTICAL PROCESS AND QUALITY CONTROL**	Theory	Practical	4
		2	2	
Course Objective	1. To understand the basic concepts of control charts for variables and their indices. 2. To discuss different control charts like Shewart's moving average, multivariate etc. with their applications. 3. To explain different sequential sampling plans and six sigma tool etc. with their properties and applications..			

Course Out comes	1. Students understood the basic concepts of control charts for variables and their indices. 2. Students performed different control charts like Shewart's moving average, multivariate etc. with their applications. 3. Students used different sequential sampling plans and six sigma tool etc. in solving the problems. 4. Students have awareness about Total Quality Management.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO2	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO3	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO4	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**

APST405 (c): ACTUARIAL STATISTICS

Unit I : Basic deterministic model: Cash flows, discount function, interest and discount rates, balances and reserves, internal rate of return, The life table: Basic definitions, probabilities, construction of life tables, life expectancy, Life annuities: Introduction, calculating annuity premium, interest and survivorship discount function, guaranteed payments, deferred annuities.

Unit II : Life insurance: Introduction, calculation of life insurance premiums, types of life insurance, combined benefits, insurances viewed as annuities, Insurance and annuity reserves: The general pattern reserves, recursion, detailed analysis of an insurance, bases for reserves, non forfeiture values, policies involving a return of the reserve, premium difference and paid-up formula.

Unit III : Fractional durations: Life annuities paid monthly, immediate annuities, fractional period premium and reserves, reserves at fractional durations, Continuous payments: Continuous annuities, force of discount, force of mortality, Insurance payable at the moment of death, premiums and reserves. The general insurance – annuity identity, Select morality: Select an ultimate tables, Changed in formulas.

Unit IV : Multiple life contracts: Joint life status, joint annuities and insurances, last survivor annuities and insurances, moment of death insurances. The general two life annuity and insurance contracts, contingent insurances

Reference

1. Neill, A. (1977) Life contingencies, Heinemann, London.
2. Newton L. Bowers, Jr, Hans U. Gerber, James C. Hickmann, Donald A. Jones and Cecil J. Nesbitt (1997) Actuarial Mathematics, The Society of Actuaries.
3. King, G. Institute of Actuaries Text Book. Part 11, Second edition, Charles and Edwin Layton, London.
4. Donald D.W.A. (1970) Compound Interest and Annuities, Heinemann, London.
5. Jordan, C.W. Jr. (1967) Life Contingencies, Second edition, Chicago Society of Actuaries.
6. Hooker, P.F. and Longley Cook, L.W. (1953) Life and other Contingencies, Volume I and Volume II (1957) Cambridge University Press.
7. Spurgeon, E.T. (1972), Life Contingencies, Third edition, Cambridge University Press.

Course Objectives:

1. To Bring the knowledge of the Life tables, Interest Rates.
2. To make the students of the aware of the Insurance systems and their benefits.

Course Outcomes:

1. Students get the knowledge of the Economic interest rates and discount rates.
2. Students know how to construct the life tables based on the Expectancy.
3. Students to get awareness of the life annuities.
4. Students ensure how to build joint life annuities and life survivor annuities.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO2	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO3	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO4	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**

APST 406 (a) : STATISTICS FOR MARKETING RESEARCH

UNIT-I: RESEARCH METHODOLOGY: Types of Research; Hypotheses; Research Design; Collection of Data; Marketing Surveys; Sampling Techniques; Research Tools: Scaling Techniques; Problems in Marketing Research; Case study Method; Preparation of Research Report.

UNIT-II: STATISTICS FOR MARKETING: Statistical Measures: Mean, Median and Mode; Standard Deviation and Coefficient of Variation; Correlation and Regression analysis; Multiple correlation and Regression; Coefficient of Association; Linear and Compound growth rates.

UNIT-III: MARKETING INFERENTIAL TECHNIQUES: Elements of probability; Concepts of Binomial, Poisson and Normal distributions; Tests of Significance: z, t, χ^2 and F tests, ANOVA Technique; Non parametric Tests; Components of Experimental Designs: CRD, RBD and LSD.

UNIT-IV: ADVANCED STATISTICS FOR MARKETING: Basic Time Series and Forecasting Methods; Determination of Trend; Process and Product control; control charts $\overline{X}$, R, p, np and c-charts; Operation Research Techniques: Linear Programming Problem-Graphical Method, concept of PERT, CPM; Concepts of Multivariate Statistical Techniques: Factor Analysis, Discriminant Analysis, Cluster Analysis, Computer Applications to Marketing Research.

References:

1. Azel and Sounderpandian, Complete Business Statistics, TMH.
2. JK Sharma, Business Statistics, Pearson.
3. RS Bhardwaj, Mathematics for Economics and Business, EB.
4. RP Hooda, Statistics for Business and Economics, McMillan.
5. GC Beri, Business Statistics, TMH.
6. Glynn Davis and BrankoPecar, Business Statistics using Excel, Oxford University press, 2010.
7. J.K. Sharma, Fundamentals of Business Statistics, 2nd Edition, Vikas Publication, 2014.
8. SC Gupta, Fundamentals of Statistics, Himalaya Publications, 2013.
9. N.D. Vohra, Business Statistics, Tata McGraw Hill, 2013.
10. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons Publishers, New Delhi.

11. S.C. Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons Publishers, New Delhi.
12. R. Pannerselvam, Research Methodology, Published by PHI Learning Private Limited, New Delhi.
13. Donald R Cooper and Pamela S Schnidler, Business Research Methods, Nineth Edition, Tata Mc Graw Hill Publishing Company Limited, New Delhi

Subject Code	Subject Name	Credits Allotted		Total
APST 406(a)	**STATISTICS FOR MARKETING RESEARCH**	Theory	Practical	4
		4	----	
Course Objective	1. To give introduction about Research Design and Statistics for Research. 2. To discuss on different Statistical measures like measures of central tendency, measures of dispersion etc. 3. To explain univariate and multivariate statistical techniques with simple applications.			
Course Out comes	1. Students learnt about Research design and how to frame questionnaire etc. 2. Statistics relating to research like univariate test like Z, t, F, ANOVA, CRD, RBD and LSD are done. 3. Multivariate statistical techniques like factor analysis, dissemination analysis and cluster analysis are used. 4. Students can understand how the marketing is happening in the real life.			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO2	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO3	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**
CO4	**3**	**1**	**1**	**2**	**2**				**1**		**1**	**1**

APST 406(b) : STATISTICAL ANALYSIS USING SPSS

Unit-I

Introduction to SPSS, Different Menu's in SPSS, creating a data file, opening excel files,variables and labels,selecting casesby filtering,recoding of data, merging of files,

Unit-II

Sorting of Cases and Variable, SPSS Output and its transfer to excel and word.Analysis categorical data- Scales of Measurements, Data reliability-test rest method, Cronbach's alpha.

Unit-III

Analysis tools – frequency tables, descriptive, cross tabulations, chi square tests. Compare-Means, ANOVA, Independent Sample t-test, Paired Sample t-test, One-way ANOVA.

Unit-IV

General Linear Model-Univariate, Multivariate, Repeated Measures.Correlation – Simple and Partial, Multiple Linear Regression-Selection variables into the model-Stepwise Multiple Linear Regression.

References

1. Statistics Made Simple-Do it Yourself on PC by K.V.S. Sarma
2. A Handbook of Statistical Analyses using SPSS-Sabine Landau and Brian S. Everitt
3. SPSS for Beginners -Vijay Gupta

Subject Code	Subject Name	Credits Allotted		Total
APST 406 (b)	**Statistical analysis using SPSS**	Theory	Practical	4
		4	----	
Course Objective	1. To understand SPSS software data entry, import and export of data 2. To use Statistical analysis tools using SPSS 3. To explain Bivariate, Multivariate statistics measures using SPSS			
Course Out comes	1. Able to create and manipulate vectors, matrices, arrays, data frames and lists. 2. Should be able to work with character data, factor data and dates. 3. Able to write scripts and function in Rand read data from. .csvfiles, EXCEL files and SPSS files. 4. Able to use built-in functions to answer questions relating to probability distributions, parametric and non-parametric hypothesis testing, correlation and regression analysis, and one-way and two-way ANOVA			

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**1**					**1**		**2**	**2**

CO2	**3**	**3**	**1**	**1**					**1**		**2**	**2**
CO3	**3**	**3**	**1**	**1**					**1**		**2**	**2**
CO4	**3**	**3**	**1**	**1**					**1**		**2**	**2**