NATIONAL EDUCATION POLICY-2020

Syllabus of Statistics

Degree with Research

and

Post Graduation

Sridev Suman Uttarakhand University

Badshahithaul (Tehri Garhwal) Uttarakhand-249199

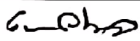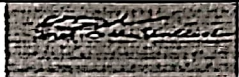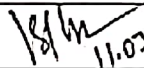**(State University of Uttarakhand)**

2023
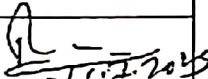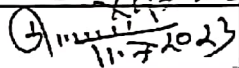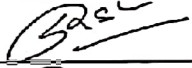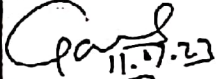
Curriculum Design Committee, Uttarakhand

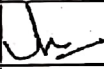| Sr.No.	Name&Designation	Chairman
1.	Prof. N.K. Joshi Vice-Chancellor, Sridev Suman Uttarakhand University, Bashahithaul, Tehri Garhwal	Member
2.	Prof. Manmohan Singh Chauhan Vice-Chancellor, Kumaun University Nainital, Uttarakhand	Member
3.	Prof. O.P.S. Negi Vice-Chancellor, Uttarakhand Open University	Member
4.	Prof. Jagat Singh Bisht Vice-Chancellor, Soban Singh Jeena University, Almora	Member
5.	Prof. Surekha Dangwal Vice-Chancellor, Doon University, Dehrdun	Member
6.	Prof. M.S.M. Rawat Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand	Member
7.	Prof. K. D. Purohit Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand	

Syllabus Preparation Committee by:

Name	Designation	Affiliation
Dr Neeraj Tiwari	Professor & Head	S. S. J. Campus, S.S.JUniversity, Almora
Prof. O. K. Belwal	Head,	Department of Statistics, HNBGU
Dr. Spersh Bhatt	Assistant Professor(Contractual)	D. S. B. Campus, KumaunUniversity, Nainital
Dr. Pushpa Panwar	Assistant Professor(Contractual)	Department of Statistics Govt. P.G. College NewTerhi, Tehri Garhwal

SRIDEV SUMAN UTTARAKHAND UNIVERSITY
Badshahithaul, Tehri Garhwal (Uttarakhand)
Members of Board of Studies Statistics

S.N.	Name of Members	Designation	Nominated As	Signature
1.	Dr. G.K. Dheengra	Professor, Head and Dean of Science	Chairman	
2.	Prof. O.K. Belwal	Professor and Head, Department of Statistics, HNBGU Srinagar Garhwal	Member	
3.	Dr. Pushpa Panwar	Department of Statistics, Govt. P.G. College, New Tehri, Tehri Garhwal	Member	
4.	Prof. K.S. Rawat	Department of Mathematics, SRT Campus, Badshahithaul	External Expert	
4.	Prof. Pushpa Negi	Principal, Govt. PG College New Tehri, Tehri Garhwal	Higher Education	
5.	Prof. Pankaj Pant	Principal, Govt PG College Nagnath Pokhri	Higher Education	
6.	Prof. Kuldeep Singh Negi	Principal, Govt. PG College Khanpur, Haridwar	Higher Education	
7.	Dr. Anita Rawat	Director, USERC, Dehradun	USERC	
8.	Prof. Anita Tomar	HOD, Mathematics, SDSUV, PLMS Campus Rishikesh	Convener	
9.	Prof. Dipa Sharma	Department of Mathematics, SDSUV, PLMS Campus Rishikesh	Member	
10.	Dr. Gaurav Varshney	Associate Professor, Department of Mathematics, SDSUV, PLMS Campus Rishikesh	Member	
11.	Dr. Dhirendra Singh	Assistant Professor, Department of Mathematics, SDSUV, PLMS Campus Rishikesh	Member	

Department of Statistics

B.Sc fourth and fifth year (VII, VIII, IX & X Sem.)

Degree with Research and

P.G. Syllabus of Statistics

Year	Sem.	Paper Title	Course Code	Theory/ Practical	CREDIT (L+P+T)
UG Fourth Year / PG First Year	UG VII / PG I Sem.	REAL ANALYSIS AND COMPLEX ANALYSIS	STAT/ T-101	Theory	4 (4+0+0)
		MATRIX THEORY AND NON PARAMETRIC INFERENCE	STAT/ T-102	Theory	4 (4+0+0)
		MEASURE AND THEORY OF PROBABILITY	STAT/ T-103	Theory	4 (4+0+0)
		STATISTICAL METHODS	STAT/ T-104	Theory	4 (4+0+0)
		PRACTICAL EXAMINATION	STAT/ P-105	Practical	4
		Research Project	STAT/ RP-106		4 (4+0+0)
	UG VIII / PG II Sem	SAMPLING THEORY	STAT/ T-201	Theory	4 (4+0+0)
		LINEAR ESTIMATION & DESIGN OF EXPERIMENT	STAT/ T-202	Theory	4 (4+0+0)
		STATISTICAL INFERENCE – I	STAT/ T-203	Theory	4 (4+0+0)
		STATISTICAL INFERENCE –II	STAT/ T-204	Theory	4 (4+0+0)
		PRACTICAL EXAMINATION	STAT/ P-205	Practical	4
		Research Project	STAT/ RP-206		4 (4+0+0)

UG Fifth Year / PG Second Year	UG IX / PG III Sem	MULTIVARIATE ANALYSIS	STAT/ T-301	Theory	4 (4+0+0)
		OFFICIAL STATISTICS	STAT/ T-302	Theory	4 (4+0+0)
		REGRESSION ANALYSIS	STAT/ T-303	Theory	4 (4+0+0)
		TIME SERIES ANALYSIS AND DEMAND ANALYSIS	STAT/ T-304	Theory	4 (4+0+0)
		PRACTICAL EXAMINATION	STAT/ P-305	Practical	4
		Research Project	STAT/ RP-306		4 (4+0+0)
	UG X / PG IV Sem	RESEARCH METHODOLOGY	STAT/ T-401	Theory	4 (4+0+0)
		STATISTICAL COMPUTING	STAT/ T-402	Theory	4 (4+0+0)
		ECONOMETRICS	STAT/ T-403	Theory	4 (4+0+0)
		POPULATION STUDIES AND DEMOGRAPHY	STAT/ T-404	Theory	4 (4+0+0)
		PRACTICAL EXAMINATION	STAT/ P-405	Practical	4
		Research Project	STAT/ RP-406		4 (4+0+0)

* Distribution of marks will be as per the university regulations.

Program Prerequisites

Candidates who have passed the three-year B.Sc. examination from any recognized university or equivalent examination of other universities with Statistics as one of the major subjects in all the three years can apply for admission in the Four Semesters M.Sc. Programme in Statistics.

Program Introduction

Statistics is a field of study that involves the collection, analysis, interpretation, presentation, and organization of data. It deals with the methods and techniques used to collect, summarize, and analyze numerical information to make informed decisions or draw accurate conclusions. In other words, statistics helps us understand and make sense of data by providing tools and frameworks for data analysis. The scope of statistics is vast and covers a wide range of areas.

The M.Sc. (Master of Science) in Statistics is a postgraduate program that focuses on advanced statistical theories, methodologies, and data analysis techniques. It is designed for individuals with a strong mathematical background who have a keen interest in understanding and analyzing data to make informed decisions. This program delves into various areas of statistics, including probability theory, statistical inference, regression analysis, experimental design, multivariate analysis, and time series analysis. Throughout the program, students are exposed to both theoretical concepts and practical applications of statistics. They learn how to formulate and test hypotheses, design experiments, collect and analyze data, and draw meaningful conclusions. The curriculum also cover programming languages like R or Python, which are commonly used for statistical analysis and data visualization. Upon completion of the M.Sc. Statistics program, students can pursue careers in a wide range of industries, such as finance, healthcare, marketing, research, and government. They often work as statisticians, data analysts, research analysts, data scientists, or consultants, utilizing their expertise in statistical modeling, data interpretation, and decision-making based on data-driven insights.

Programme Outcomes (POs)
The curricula of the subject of Statistics are designed keeping in view the following programmeoutcomes:

PO1	Capable of delivering basic disciplinary knowledge gained during the programme.
PO2	Capable of describing advanced knowledge gained during the programme.
PO3	Capable of analyzing the results critically and applyingacquired knowledge to solve the problems.
PO4	Capable to identify, formulate, investigate and analyze thescientific problems and innovatively to design and create products and solutions to real life problems.
PO5	Ability to develop a research aptitude and apply knowledge to find the solution of burning research problems in the concerned and associated fields at global level.
PO6	Ability to gain knowledge with the holistic andmultidisciplinary approach across the fields.
PO7	Learn specific sets of disciplinary or multidisciplinaryskills and advanced techniques and apply them for betterment of mankind.
PO8	Ability to learn lifelong learning skills which are importantto provide better opportunities and improve quality of life. Capable to establish independent startup/innovation center etc.

Programme specific outcomes (PSOs)
Bachelor (Research of Science (Statistics)/Master of Science (Statistics)
The post graduates shall be able to realise the following outcomes by the end of program studies:

PSO1	Will have a deep understanding of statistical theory, methods, and techniques used in data analysis and research.
PSO2	Will be proficient in analyzing and interpreting large datasets using statistical software packages and programming languages.
PSO3	Will be able to communicate statistical findings effectively to both technical and non-technical audiences, through written reports, presentations, and visualizations.
PSO4	Will be able to develop and apply various statistical models to real-world problems in fields such as finance, healthcare, social sciences, or engineering.
PSO5	Will possess the skills to conduct independent statistical research, including formulating research questions, designing studies, collecting data, and drawing valid conclusions.
PSO6	Will be able to use scientific approaches to develop the domain of human knowledge through the use of empirical data expressed in quantitative form.

UG VII /PG I Sem.

PAPER I: REAL ANALYSIS AND COMPLEX ANALYSIS

COURSE CODE: STAT/T-101

UNIT I: Continuity and discontinuity of functions, Differentiability, Roll's theorem, Mean Value theorem,

UNIT II: Non differentiable functions, Riemann integration, Fundamental theorem of integral calculus, convergence of integrals and uniform convergence.

UNIT III: Analytic functions, Conformal representation, complex integration, Cauchy's Theorem, Morea's Theorem, Taylor's and Laurentts Series

UNIT IV: Zero's and Poles of Functions, theory of Residues and Its application to Contour integration

BOOKS RECOMM ENDED:

Apostol, T.M. (1985): Mathematical Analysis, Narosa Indian Edn.
Shanti Narain: A Course in Mathematical Analysis, S. Chand and Company (Pvt.) Ltd.
Ruddin, Walter (1976): Principles of Mathematical Analysis, McGraw Hill.
Ahlfors, L.V.: Complex Analysis, Mc. Graw Hill
Copson, E.T.: Complex Variable, Oxford University Press

PAPER II: MATRIX THEORY AND NON PARAMETRIC INFERENCE
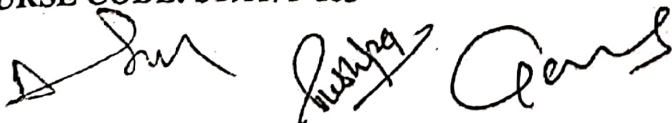
COURSE CODE: STAT/T-102

UNIT I: Inverse of a matrix, Characteristic roots and vectors, vector spaces

UNIT II: Basis, orthonormal basis of sub-spaces. generalized Inverse, solutions of non Homogenous equations, quadratic forms (real field).

UNIT III: Non- parametric methods, Sign test, Run test, Mann- Whitney U-statistics, Kruskal Walls test, test for Randomness, Test for normality.

UNIT IV: Linear rank statistic and general two way sample problem, Linear rank tests for location and scale problems, rank test for one way and two way classified data, Multivariate non parametric test for one sample location problems

BOOKS RECOMM ENDED:

Searle Sr. 1982. Matrix Algebra. Matrix Algebra useful for Statistics. John Wilcy.
Hohn FE. 973. Elementry Matrix Algebra. Macmillan.
Vatssa BS. 1994. Theory of Matrices. 2nd Ed. Wiley Eastern.
Narayan Shanti. 1994. A Text book of Matrices. 9th Ed. S. Chand & Company
Gibbons. Non Parametric Statistical Inference.
Siegel S, Johan N & Castellan Jr. 1956. Non Parametric Test for Behavioral Sciences. John Wiley.

Paper III: MEASURE AND THEORY OF PROBABILITY

COURSE CODE: STAT/T-103

UNIT I: Fields and Measurable functions, Definition of Measure and probability,
UNIT II: Random Variable, Definition of Integral and expectation of Random variable, Distribution function of a Random variable and Decomposition Theorem, Characteristic function and its elementary properties. Uniqueness, Inversion and continuity theorems for C.F. Kolmogorov's inequality. Chebyshev's Inequality. Law of large numbers, Central limit theorem.
UNIT III: Convergence of sequence of random variables. Convergence in Probability, in mean square and almost sure. The weak law of large numbers, The strong law of large numbers
UNIT IV: Bernoulli's, Kintchin's theorems, Central limit theorem Lindberg - Levy and Liapounov's form, Borel- Cantelli Lemma, Borel zero-one law.

BOOKS RECOMMENDED:
Rohatgi VK & Saleh AK Md. E. 2005. An introduction to Probability and Statistics. 2nd Ed. John Wiley. Feller W. 1972. An Introduction to Probability Theory & Applications (Vol 1 and II). John Wiley. Marek F. 1963. Probability Theory and Mathematical Statistics. John Wiley.
Bhatt BR. 1999. Moderen Probability Theory. 3rd Ed. New Age International

Paper IV: STATISTICAL METHODS

COURSE CODE: STAT/T-104

UNIT I: Discrete Probability Distributions, Negative-binomial, Geometric and Hyper Geometric, Uniform, Multinomial - properties of these distributions and real life examples.
UNIT II: Continuous Probability Distributions, Cauchy, Gamma, Beta of two kinds, Weibull, Lognormal, Logistic, Pareto, Exponential distributions, Extreme value distributions. Properties of these distributions . Probability distributions of functions of random variables. Order statistics, Distribution of order statistic.
UNIT III: Sampling distributions of sample mean and sample variance from Normal Population, Central and non- central Chi-Square. t and F distributions, their properties and interrelationship.
UNIT IV: Distribution of quadratic forms, sampling distribution of correlation coefficient, regression coefficient, correlation ratio, Intra class correlation coefficient, etc.

BOOKS RECOMMENDED:
Rao CR.1965. Linear Statistical Inference and its application. John Wiley
Dudewicz EJ & A Mishra SN. 1988. Modern Mathematical Statistics. John Wiley.
Murek F. 1963. Probability Theory and Mathematical Statistics. John Wiley.
Johnson NL., Kotz S & Balakrishnan N. 2000. Discrete Univariate Distibutions. John Wiley.
Johnson NL., Kotz S & Balakrishnan N. 2000. Continuous Univariate Distibutions. John Wiley.

PAPER V: PRACTICAL EXAMINATION

COURSE CODE: STAT/P-105

A Practical examination based on above papers.

PAPER VI: RESEARCH PROJECT

COURSE CODE: STAT/RP-106

Project based on above papers.

PAPER I: SAMPLING THEORY

COURSE CODE: STAT/T-201

UNIT I:. Small Area Estimation: Basic concepts, uses and introduction to methods used for small area estimation. Non Sampling errors, problems of Non Response, errors of measurement, Randomised Response techniques

UNIT II: Circular systematic sampling.Cluster Sampling: Estimates of mean and Variance for equal and unequal clusters, Efficiency in terms of Intra class correlation, Optimum unit of sampling.

UNIT III: Ratio and regression method of estimation. sampling with replacement and unequal probabilities, Estimation of mean and it's variance, Double sampling, Multistage sampling with special reference to two stage design, Interpenetrating sub-sampling,

UNIT IV: Sampling with varying probabilities with and without replacement, PPS sampling, Cumulative method and Lahiri's method of selection, Horvitz-Thompson estimator, Ordered and unordered estimators, Sampling strategies due to Midzuno-Sen, Sampford and Rao-Hartley-Cochran, inclusion probability proportional to size sampling, PPS systematic sampling.

BOOKS RECOMMENDED:
Cochran WG. 1977. Sampling Techniques. John Wiley.
Murthy MN. 1977. Sampling Theory And Methods. 2nd Ed. Statistical Publ. Soc., Calcutta.
Mukhopadhyay P. 1998. Theory and Methods of Survey Sampling. Prentice Hall of India Pvt. Ltd., New Delhi.
Des Raj & Chandhok P. 1988. Sample Survey Theory. Narosa Publ. House.
Sukhatme PV, Sukhatme BV, Sukhatme S & Asok C. 1984. Sampling Theory of Surveys with Applications. Sampling Theory of Surveys with Applications. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.
Thompson SK. 2000. Sampling. John Wiley.

PAPER II: LINEAR ESTIMATION & DESIGN OF EXPERIMENT
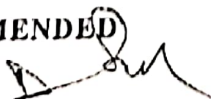
COURSE CODE: STAT/T-202

UNIT I: Theory of Linear Estimation; Linear Model, Gauss Markoff set up, Aitken's transformation, Gauss Markoff Theorem, Test of linear hypothesis and related confidence interval, ANCOVA
UNIT II: Heterogeneity settings, connectedness, balance, orthogonal structures, contrasts, Balanced incomplete block design and Lattice design, Recovery of intra-block information, Latin square, mutually orthogonal latin squares, Youden squares,
UNIT III: Factorial Experiments- 2" and 3' designs, confounding in factorial experiments,
UNIT IV: Missing Plot technique. Uniformity Trials. Split Plot and Strip plot Design.

BOOKS RECOMMENDED)

Joshi DD. 1990. Linear Estimation and Design of Experiment. First reprint. Wiley Eastern Ltd.
Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
Federer WT. 1985. Experimental Designs. MacMillan
Nigam AK & Gupta VK. 1979. Handbook on Analysis of Experiments. IASRI Publ.
Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer.
Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.

PAPER III: STATISTICAL INFERENCE - I

COURSE CODE: STAT/T-203

UNIT I: Admissibility, Properties of good estimators- Efficiency, Sufficiency and completeness, Cramer—Rao inequality and its generalization,

UNIT II: Bhattacharya's Bounds, Characteristics of distribution admitting sufficient statistic, Rao-Blackwell Theorem and Lehmann - Scheffe theorem.

UNIT III: Method of Estimation, Method of Maximum Likelihood, Method of Moments, Method of Chi-Square, Properties of M.L.E, existence of best asymptotic normal estimate under regularity conditions,.

UNIT IV: Interval Estimation, Confidence Regions, Best Confidence Intervals, Interval Relationship with the Testing of Hypothesis.

BOOKS RECOMMENDED:
Rohatgi VK. 1984. Statistical Inference. John Wiley
Rohatgi VK & Sala AK. Md. E. 2005. An Introduction to Probability and Statistics. 2I'd Ed. John Wiley
Joshi DD. 1990. Linear Estimation and Design of Experiment. First reprint. Wiley Eastern
Rao CR. 1973. Linear Statistical Inference And Its Applications. 2nd Ed. Wiley Eastern

PAPER IV: STATISTICAL INFERENCE –II

COURSE CODE: STAT/T-204

UNIT I: Testing of Hypothesis- Neyman Pearson Lemma and its generalization, UMP Tests, Unbiased Tests, UMPU Tests, Tests with Neyman structure and UMP similar tests, Likelihood Ratio tests and their large sample properties along with simple applications.

UNIT II: Restricted parameter estimation, General two way classification, without and with interactions, nested classification, Polynomial regression models and orthogonal polynomials.

UNIT III: Sequential Analysis- Need of Sequential Probability Ratio tests and it's properties, Wald's fundamental identity, OC and ASN function, Optimality of SPRT, Applications to Normal, Binomial and Poisson Distributions, Sequential estimation- Basic idea, Stein's two stage procedure.

UNIT IV: Bayesian Inference- General structure of a Bayesian Decision problem, role of loss function, Risk function, Prior information, Application of Bayes theorem in computing posterior distributions, Bayes estimators of the posterior mean under squared error loss, Bayesian notion of sufficiency.

BOOKS RECOMMENDED:
Rohatgi VK. 1984. Statistical Inference. John Wiley
Rohatgi VK & Sala AK. Md. E. 2005. An Introduction to Probability and Statistics. 2I'd Ed. John Wiley

Joshi DD. 1990. Linear Estimation and Design of Experiment. First reprint. Wiley Eastern
Wald A. 2004. Sequential Analysis. Dover Publ.
Sinha Sk 1998. Bayesian Estimation. New Age International.
Winkler. Introduction To Bayesian Inference
E. L Lehman. 1990. Testing of Hypothesis. John Wiley

PAPER V: PRACTICAL EXAMINATION

COURSE CODE: STAT/P-205

A Practical examination based on above papers

PAPER VI: RESEARCH PROJECT

COURSE CODE: STAT/RP-206

Project based on above papers.

PAPER I: MULTIVARIATE ANALYSIS

COURSE CODE: STAT/T-301

UNIT I: Non Singular and Singular Multivariate Normal distributions, Marginal and Conditional distributions, Characteristic Function and Moment Generating Functions,

UNIT II: Maximum Likelihood Estimation of Mean and Co-Variance matrix, independence and joint sufficiency for these estimates, Hotelling's T2 statistic as a function of the Likelihood Ratio criterion, It's distribution and applications, Mahalanobis D^2 statistic and it's distribution.

UNIT III: Discriminant function (for two variables), Principal Components and Canonical Correlations.

UNIT IV: Path Analysis, Factor Analysis, Cluster Analysis, Discriminant Analysis, MANOVA

BOOKS RECOMMENDED:

Anderson, TW. 1958. An introduction to Multivariate Statistical Analysis. John Wiley.
Dillon WR & Goldstein M. 1984. Multivariate Analysis - Methods and Applications. John Wiley.
Morrison DF. 1976. Multivariate Statistical Methods. McGraw Hill.
Gill NC. Multivariate Statistical Inference

PAPER II: OFFICIAL STATISTICS

COURSE CODE: STAT/T-302

UNIT I: Introduction to Indian and International Statistical systems. Present Official Statistical System in India, role, functions and activates of central and state organization. Organization of large scale sample surveys methods of collection of official statistics, Role of National Sample Survey Organization.

UNIT II: General and special data dissemination systems, population growth in developed and developing countries. Evaluation of performance of family welfare programs projection of labor force and manpower. Scope and content of population of census of India.

UNIT III: System of collection of agriculture Statistics, Crop forecasting and estimation. Support prices buffer stock, impact of irrigation projects.

UNIT IV: Statistics related to industries, balance of payment, cost of living, educational and other Social Statistics.

BOOKS RECOMMENDED

Basic Statistics relating to Indian Economy (CSO) 1990.
Statistical system in India (CSO) 1975.
Guide to Official Statistics (CSO) 1999.
Principles and accommodation of National Populations Census. UNESCO.

PAPER III: REGRESSION ANALYSIS

COURSE CODE: STAT/T-303

UNIT 1: Simple and multiple Linear regression, Least squares fit- Properties and example, Polynomial Regression, Use of orthogonal polynomials

UNIT II: Assumptions of regression, diagnostics and transformations, Examination of Residuals, - Studentized residuals, applications of residuals in detecting outliers, identification of influential observations, Lack of fit , pure error, Testing homoscedaSticity and normality of errors, Durbin Watson test, Use of R^2 in examining goodness of fit, other measures of goodness of fit.

UNIT III: Concepts of Least median of squares and its applications, Concept of Multicollinearity, Analysis of Multiple Regression Models, estimation and testing of regression parameters, sub hypothesis testing, restricted estimation

UNIT IV: Weighted Least squares method: Properties and it's examples, Box-Cox family of transformation, Using of Dummy variables, Selection of variables, Forward Selection, Backward elimination, Stepwise and Stagewise regression

BOOKS RECOMMENDED:

Balsley DA, Kuh E & Walsch RE. 2004. Regression Diagnostics --Identifying Influential Data and Sources Of Coll inearity. John Wiley.

Chatterjee S, Hadi A,& Price B. 1999. Regression Analysis by Examples. John Wiley.

Montgomery DC, Peck EA & Vining GG. 2003. Introduction to Linear Regression Analysis. 3rd Ed. John Wiley.

Draper & Smith.2005. Applied Regression Analysis, John Wiley

PAPER IV: TIME SERIES ANALYSIS AND DEMAND ANALYSIS

COURSE CODE: STAT/T-304

UNIT I: Components of a time series and their measurement, Harmonic Analysis, Autocorrelation and Partial Autocorrelation functions, Correlogram and periodogram analysis,

UNIT II: Linear Stationary models, Autoregressive, Moving Average and mixed processes, Linear non Stationary models, Autoregressive integrated moving average processes Forecasting: Minimum mean square forecast and their properties, calculating and updating forecast

UNIT III: Model identification techniques and objectives, initial estimates, Model estimation: Likelihood function, sum of squares function, Least square estimates, Seasonal models, Intervention analysis models and Outlier detection

UNIT IV: Demand Analysis: Distribution of income, income and demand elasticities, Method of estimation of elasticities using family budget data and time series data, Engel's curve and Engel's law
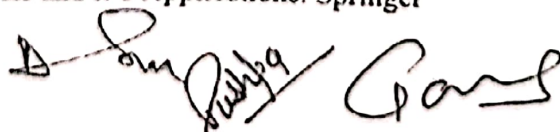
BOOKS RECOMMENDED:

Barnett V & Lewis 'I'. 1984. Outliers in Statistical Data. John Wiley.

Douglas Montgomery. 2003. Introduction to Time Series Analysis and Forecasting. Wiley

Box GEP, Jenkins GM & Reinsel GC. 2007. Time Series Analysis: Forecasting and Control. 3"1 Ed. Pearson Edu

Robert H Shumway. 2000. Time Series Analysis and it's Applications. Springer

PAPER V: PRACTICAL EXAMINATION

COURSE CODE: STAT/P-305

A Practical examination based on above papers

PAPER VI: RESEARCH PROJECT

COURSE CODE: STAT/RP-306

Project based on above papers.

PAPER I: RESEARCH METHODOLOGY

COURSE CODE: STAT/T-401

Meaning of Research – Objective of Research – Approach to research – significance of research – type of research – research in Social Sciences – facts, theories and concepts in Social Science research – research design – features of a good research design.

Research problem – Identifying the research problem – formulation of research problem-concept of hypothesis – role and formulation of hypothesis – scientific method of research – nature of scientific research – stages of scientific method.

Logic and scientific method – Deductive and inductive methods – the Case study method-merits and demerits of Case study methods – survey methods – merits and demerits of survey methods – types of survey – selecting the survey method – sample surveys – different types – merits and demerits.

Schedule and questionnaire – Principle underlying the construction of questionnaire-measurement and scaling techniques – processing and analysis of data.

Interpretation and report writing – Steps – bibliography, quality of a good research report.

BOOKS RECOMMENDED
Kothari, C.R. (1985): Research Methodology: Methods and Techniques, Wiley Eastern.
Dominowski, R.L. (1980): Research Methods, Prentice Hall Inc., New Jersey.
Mishra, R.P. (1980): Research Methodology, Handbook Concept Publishing Company, New Delhi.
IIPS (1996): Research Methodology, IIPS, Mumbai.

PAPER II: STATISTICAL COMPUTING

COURSE CODE: STAT/T-402

UNIT I: Computer organization, problem analysis, Algorithm development, Flow chart, Data type, operators and expressions, Assignment statement, Arithmetic and logical operation, List directed and Format-directed Input / Output statement.
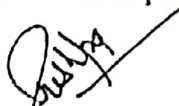
UNIT II: Windows: Use of windows, its operations and applications.

UNIT III: MS excel: Use of MS excel, its operations, solution of statistical problems using MS excel.

UNIT IV: A statistical package such as SPSS, MINITAB and R

BOOKS RECOMMENDED
Agresti A. 2002. Categorical Data Analysis. 2nd Ed. John Wiley.
'Misted RA. 1998. Elements of Statistical Computing. Chapman & Hall.

B. Ryan and B.L. Joiner (2001): Minitab handbook, 4th edition, Duxbury.
R.A. Thisted (1988): Elements of statistical computing, Chapman and hall.
Ilan J & Kamber M. 2000. Data Mining : Concepts and Techniques. Morgan. Packages:
SPSS/R/Statistica/SYSTAT

PAPER III: ECONOMETRICS

COURSE CODE: STAT/T-403

UNIT I: Models and identification, meaning of Econometrics, formulation of economic phenomenon with specification analysis, Simultaneous equations, meaning of structure and model problems involved in construction of economic models

UNIT II: Endogenous and Exogenous Variables, concept of Multicollinearity, Identification Problems, rank and order condition of Identifiability, identification under bilinear restrictions, identifiability everywhere in the parametric space, WALA'S criterion of identification

UNIT III: Estimation: method of estimation, two stage and three stage least squares, K- class estimates with properties(Bias and Moment matrix),

UNIT IV: Maximum Likelihood estimators, full information and limited information maximum likelihood estimators, Monte Carlo Studies

BOOKS RECOMMENDED:
Koop G. 2007. Introduction to Econometrics. John Wiley.
Maddala GS. 2001. Introduction to Econometrics. 3rd Ed. John Wiley.
Pindyck RS & Rubinfeld DL. 1998. Econometric Models and Economic Forecasts. 4'11 Ed.
McGraw Hill.
Verbeek M. 2008. A Guide to modern Econometrics. 3rd Ed. John Wiley.
G. M. K Madnani. 2008. Introduction to Econometrics.8th Ed. Oxford and IBH

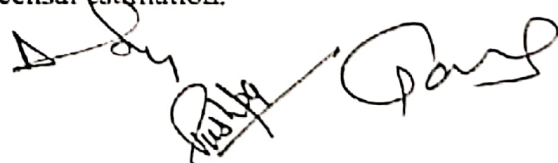## PAPER IV: POPULATION STUDIES AND DEMOGRAPHY

COURSE CODE: STAT/T-404

UNIT I: History, definition, nature and scope of Population Studies, relationship of other social sciences with population studies, Population Surveys: Meaning, Scope, uses, limitations; Major surveys: National Sample Surveys (NSS), World Fertility Survey (WFS), Demographic Health Surveys (DHS), Reproductive and Child Health Survey (RCHS). National Family Health Surveys (NFHS)

UNIT II: Method of Population Projection: Mathematical methods of population projection (Linera, Exponential, Polynomial, Gompertz and Logistic Growth Curves for Population Projection); Component method of Population projection; Sub-national population projection;

UNIT III: Demography: Its definition, nature and scope, its relation with other disciplines, Theories of population-Malthusian Theory, Optimum theory of population and theory of Demographic Transition. Sources of Demographic data, limitations and uses of demographic data,

UNIT IV: Vital rates and Ratios, definition and construction of life tables from Vital Statistics, census returns, uses of life table, , measure of fertility gross net reproduction rates, stationary and stable population theory, uses of Lotka's stable population theory in the estimation of demographic parameters, method of inter-censal and post-censal estimation.

BOOKS RECOMMENDED:

Cox DR. 1957. Demography. Cambridge Univ. Press.
Rowland Di'. 2004. Demographic Methods and Concepts. Oxford Press.
Sigel JS & Swanson DA. 2004. The Methods and Material of Demography. 2"d Ed. Elsevier.
Woolson FR. 1987. Statistical Methods for the Analysis of Biomedical Data. John Wiley.
Wald H. Demand Analysis
Kendall MG. Advanced Theory of Statistics Vol-11

PAPER V: PRACTICAL EXAMINATION

COURSE CODE: STAT/P-405

A Practical examination based on above papers.

PAPER VI: RESEARCH PROJECT

COURSE CODE: STAT/RP-406

Project based on above papers.