

# M.Sc./M.A. (STATISTICS)

## SCHEME OF EXAMINATION

The examination for the degree of Master of Arts/Science in Statistics shall consist four semesters in two years.

Admission to the M.A./M.Sc. course in Statistics will be open to those who have offered in Statistics at the B.A./B.Sc. Part I, II and III examinations.

There shall be four theory papers and one practical in each semester and each paper will carry 100 marks and practical also carries 100 marks. The theory paper will be of three hours duration and practical will be of four hours duration. For the practical there shall be 15 & 10 marks for the practical records and Viva-voce respectively. The papers for the practical examination shall be set jointly by the external and internal examiners.

### SCHEDULE OF PAPERS

<b>FIRST SEMESTER</b>		<b>THIRD SEMESTER</b>	
PAPER- I	Measure and Integration	PAPER- I	Stochastic Process
PAPER-II	Sampling Theory	PAPER-II	Multivariate Analysis-I
PAPER-III	Linear Estimation and Theory of Block Designs.	PAPER-III	Statistical Inference
PAPER-IV	Operations Research-I	PAPER-IV	Econometrics
PRACTICAL		PRACTICAL	
<b>SECOND SEMESTER</b>		<b>FOURTH SEMESTER</b>	
PAPER- I	Probability Theory	PAPER- I	Applied Stochastic Models
PAPER-II	Advanced Sampling Theory	PAPER-II	Multivariate Analysis-II
PAPER-III	Design and Analysis of Experiments	PAPER-III	Sequential Analysis and Decision Theory
PAPER-IV	Operations Research-II	PAPER-IV	Time Series Analysis
PRACTICAL		PRACTICAL	

**M.Sc./M.A. (STATISTICS )**  
**First Semester**  
**MEASURE AND INTEGRATION**  
**PAPER-I**

- UNIT-I Algebra of sets, Limit of a sequence of a sets, Field of sets, Monotone Classes, Sigma field, Boral field, set function, Additive set function, Continuity of set function.
- UNIT-II Measure and its properties, Lebesgue and Lebesgue-Stiltjes measure, probability measure sequence theorem.
- UNIT-III Measurable Space, Measurable sets, Simple Function, Elementary Function, Measurable Function, Measurability theorem, Convergence in measure, Convergence almost everywhere.
- UNIT-IV Integration of measurable function with respect to a measure, Helly- Bray lemma & Helly- Bray theorem, Dominated Convergence theorem, Monotone Convergence theorem, Fatoulemma.

Book for reference:

- |       |                             |  |
|-------|-----------------------------|--|
| (i)   | Paul R. Halmos              | Measure Theory                           |
| (ii)  | P.K. Jai & V.P. Gupta       | Lebesgue measure and Integration         |
| (iii) | B.R. Bhatt                  | Modern Probability Theory                |
| (iv)  | Singman S.J. and Taylor JFC | Introduction to Measure and Probability. |

**M.Sc./M.A. (STATISTICS )**  
**First Semester**  
**SAMPLING THEORY**  
**PAPER-II**

- UNIT-I      Review of some important results in SRSWOR and SRSWR, estimator of population mean/total and its variance for stratified populations, Estimation of gain in precision due to stratification, Post stratification, estimation of population mean and its variance under post stratification, inaccuracy in strata sizes and their effect, comparison with estimator under SRSWOR.
- UNIT-II      Ratio method of estimation, second approximation to the expectation and variance of ratio estimator, An optimum property of ratio estimator, ratio estimator for stratified population, Separate and combined ratio estimators and their variance, estimate of variance, ratio type and unbiased ratio type estimators and their variances, product estimator, comparison with estimator under SRSWOR, ratio cum product estimator and their MSE.
- UNIT-III     Regression method of estimation, Difference estimator, regression estimator of population mean/total, its bias and MSE, conditions under which regression estimator is optimum, weighted regression estimator and its variance, regression estimation for stratified population, separate and combined regression estimator and their MSE, estimate of variances.
- UNIT-IV     Systematic sampling, comparison of systematic with SRSWOR and stratified sampling for auto-correlated population and population with linear trend, balanced systematic sampling, centrally located sample, end correction.

Interpenetrating sub samples and its application in stratified sampling.

Book for reference:

- |  |   |
|--|---|
| (i) Sukhatme, P.V., Sukhatme, B.V.<br>Sukhatme, S and Ashok, C | Sampling Theory of Surveys with Applications  |
| (ii) Cochran, W.G.   | Sampling Techniques                           |
| (iii) Murthy, M.N.   | Sampling Theory and Methods                   |
| (iv) Des Raj   | Sampling Theory                               |
| (v) Singh, D. and Chaudhary, F.S.                              | Theory and Analysis of Sample Survey Designs. |

**M.Sc./M.A. (STATISTICS )**  
**First Semester**  
**LINEAR ESTIMATION AND THEORY OF BLOCK DESIGNS**  
**PAPER-III**

- UNIT-I      Generalised inverses of a matrix, Idempotent matrix, Random Vector and dispersion matrix, Linear Model, Estimable parametric function and condition of estimability, Estimation space, Error space and error function, Best estimate (BLUE), Gauss-Markoff's linear model, Normal equation, Residual Vector, Theory of linear estimation, Gauss Markoff's Theorem and estimate of variance, Variance and covariance of estimates.
- UNIT-II      Simple and multiple linear regression model, Test of linear hypothesis regarding the parameter for two variable linear model as well as multivariate linear regression model.
- UNIT-III     Two-way cross- classification with equal number (more than one) of observations per cell, Two way cross- classification with unequal numbers of observations in the cells, Nested or hierarchical classification, Two-way elimination of heterogeneity.
- UNIT-IV     General theory of intra-block analysis of block design, contrast and elementary treatment contrast, connected and orthogonal block design, Balanced and resolvable block design, Missing plot technique in R.B.D., Efficiency of R.B.D. with one missing value over no missing value.

Book for reference:

- |        |                               |  |
|--------|-------------------------------|--|
| (i)    | Chakrabarti, M.C.             | Mathematics of design and analysis of Experiments. |
| (ii)   | Aloke Dey                     | Theory of Block Designs                            |
| (iii)  | M.N. Das and N.C. Giri        | Design and analysis of experiments.                |
| (iv)   | D.D. Joshi                    | Linear estimation and design of experiments.       |
| (v)    | C.R. Rao                      | Linear Statistical inference and its Application   |
| (vi)   | Goon, Gupta, Das Gupta        | An outline of Statistical theory, (Vol. 2)         |
| (vii)  | Goon, Gupta, Das Gupta        | Fundamentals of Statistics (Vol. 2)                |
| (viii) | Gupta , S.C. and Kapoor, V.K. | Fundamentals of Applied Statistics.                |

**M.Sc./M.A. (STATISTICS )**  
**First Semester**  
**OPERATIONS RESEARCH-I**  
**PAPER-IV**

- UNIT-I      Formulation of an LPP. Graphical Solution to an LPP (two variables) Concept of General LPP and its reformulation as standard LPP. Definitions: Slack and Surplus Variables, Solution, Feasible Solution, Basic Solution, Basic feasible solution and Optimum Basic Feasible Solution. Theorems for reduction of feasible solution to basic feasible solution, replacement of basis vector, extreme point correspondence, condition for optimality and unboundedness.
- UNIT-II      Simplex Algorithm, artificial variable, Big-M and two phase methods, Dual simplex method Solving Problem with and without artificial variables.
- UNIT-III     Transportation Problem: Problem as an LPP, theorem relating loop and independence of vectors, initial basic feasible solution (N-W corner, Vogel's methods), Optimum solution using U-V method. Degeneracy and unbounded problems, Assignment problems, Hungarian method.
- UNIT-IV     Project management :CPM : Drawing network diagram, critical path, labeling of nodes, slack, floats PERT: estimate of project duration, estimate of variance of project duration, probabilities related to duration of the project.

Book for reference:

- |       |  |   |
|-------|--|---|
| (i)   | Taha H.A. (1982)                                 | Operations Research :An Introduction, Macmillan |
| (ii)  | Kanti Swarup, Gupta, P.K. and Singh, M.M. (1985) | Operations Research: Sultan Chand & Sons.       |
| (iii) | Philips D.T., Ravindran A. and Solberg J.        | Operations Research : Principles and Practices  |
| (iv)  | Churchman C.W. Ackoff R.L. Arnoff E.L. (1957)    | Introduction to Operations Research; John Wiley |
| (v)   | Hadley, G. (1987)                                | Linear Algebra, Narosa Publishing House.        |

PRACTICAL : Based on Paper II, III and IV.

**M.Sc./M.A. (STATISTICS )**  
**Second Semester**  
**PROBABILITY THEORY**  
**PAPER-I**

- UNIT-I      Probability space, Probability function and its properties, conditional probability function, Independence of events, Random variable, Distribution function and its properties.
- UNIT-II      Convergence of a sequence of random variables, Convergence in distribution, Convergence in probability, Almost sure convergence, convergence in  $r^{\text{th}}$  mean.
- UNIT-III     Characteristic function of real and vector valued random variable, Inversion theorem, continuity theorem, Limit theorem.
- UNIT-IV     Weak law of large numbers, Boral contelli lemma, Boral's zero one law, strong law of large number, Kolmogorov's law large number, Central Limit theorem (Linderberg-Lavy, Demoiver's- Laplace Liapnov's)

Book for reference:

- |       |                        |   |
|-------|------------------------|---|
| (i)   | Michel Loeve           | Probability Theory  |
| (ii)  | W. Feller              | An Introduction to Probability Theory and its application |
| (iii) | B.R. Bhatt             | Modern Probability Theory                                 |
| (iv)  | Goon, Gupta, Das Gupta | An outline of Stat. (Vol. 4)                              |

**M.Sc./M.A. (STATISTICS )**  
**Second Semester**  
**ADVANCED SAMPLING THEORY**  
**PAPER-II**

- UNIT-I Unequal probability sampling, methods of samples selection in PPSWR and PPSWOR, estimator of population mean and its variance under PPSWR, comparison between ordered and unordered estimators, Des-Raj ( $n=2$ ) estimator, Horvitz- Thompson estimator for population mean/total and its variances, Midzuno system of sampling.
- UNIT-II Cluster sampling for unequal clusters, biased and unbiased estimators of population mean/total and their variances, variance of unbiased estimator in terms of Intra class correlation coefficient, ratio and regression estimators and their MSE, estimated variances of different estimators.
- UNIT-III Two stage sampling for unequal first stage unit, biased and unbiased estimators of population mean/total and their variances, ratio and regression estimators and their MSE, estimated variances of different estimators, Allocation of sample.
- UNIT-IV Two phased sampling, double sampling for stratification, double sampling for ratio estimator double sampling for regression estimator.
- Non- sampling errors, different types and sources of non-sampling errors, problem of non-response, Hansen and Horvitz technique, Politz and Simmons technique, observational errors and their measurement.

**Book for reference:**

- |       |  |   |
|-------|--|---|
| (i)   | Sukhatme, PV. Sukhatma, BV<br>Sykhatma, S. and Ashok, C. | Sampling Theory of Surveys with Applications.   |
| (ii)  | Cochran, W.G.  | Sampling Techniques                             |
| (iii) | Murthym, M.N.  | Sampling Theory and Methods                     |
| (iv)  | Des Raj  | Sampling Theory                                 |
| (v)   | Singh D. and Chaudhary,                                  | F, Theory and Analysis of sample survey design. |

**M.Sc./M.A. (STATISTICS )**  
**Second Semester**  
**DESIGN AND ANALYSIS OF EXPERIMENTS**  
**PAPER-III**

- UNIT-I Complete block design, Incomplete block design, BIBD : Its intra-block analysis and its properties, Fisher's inequality, Efficiency of BIBO over R.B.D. Symmetric BIBD, Resolvable BIBD.
- UNIT-II General factorial experiment, Main and interaction effect, Study of 2<sup>nd</sup> and 3<sup>rd</sup> factorial experiment, Standard order of treatment combination, Yate's method of computing factorial effect totals, Calculation of sum of squares for main and interaction effects, Analysis of factorial experiment in RBD, Advantage and disadvantage of factorial experiment, Split plot experiment.
- UNIT-III Confounding in factorial experiment, Confounding arrangement, Defining contrasts, Confounding in 2<sup>nd</sup> factorial experiments and its analysis, Generalized interactions, General rule in confounding, Principal (Key) block, Complete and partial confounding, analysis of complete and partially confounded 2<sup>nd</sup> experiment, advantage and disadvantage of confounding.
- UNIT-IV Analysis of covariance (ANOCOVA), ANOCOVA for one way classification (CRD) with one concomitant variable, ANOCOVA for two way classification (R.B.D.) with one concomitant variable.

**Book for reference:**

- |       |                        |  |
|-------|------------------------|--|
| (i)   | Chakrabarti, M.C.      | Mathematics of design and analysis of experiments. |
| (ii)  | Aloke Dey              | Theory of Block Designs                            |
| (iii) | M.N. Das and N.C. Giri | Design and analysis of Experiments.                |
| (iv)  | D.D. Joshi             | Liner estimation and design of experiment.         |



**M.Sc./M.A. (STATISTICS )**  
**Second Semester**  
**OPERATIONS RESEARCH-II**  
**PAPER-IV**

- UNIT-I      Duality in LPP : Dual of the primal LPP, examples, Dual of the dual, Weak and strong duality theorems, Getting optimum solution to the dual from optimum solution to the primal.
- UNIT-II      Concept of two person zero sum game, Concept of Payoff matrix, pure and mixed strategy, saddle point, value of the game and expected value of the game.
- Mixed strategy : Algebraic solution for  $2 \times 2$  game, graphical method to reduce  $2 \times n$  in  $2 \times 2$  game, Method of dominance.
- UNIT-III     Reduction of game as on LPP and its solution using duality, Monte Carlo Simulation: Concept and procedure of drawing a random sample from a hypothetical population, Simple example with rectangular distribution, exponential distribution, categorical distribution, Area of circle and one dimensional integrals.
- UNIT-IV     Inventory Models: Concepts, EOQ models with and without shortage, Single period probabilistic model (discrete case)
- Replacement Models: Replacement of capital equipment (value of the money remains constant. Group replacement and individual replacement of items failing completely.

**Book for reference:**

- (i)      Taha H.A. (1982)                      Operational Research: An Introduction; Macmillan
- (ii)     Kanti Swarup, Gupta, P.K. and      Operations Research; Sultan Chand & Sons  
           Singh, M.M. (1985)
- (iii)    Philips D.T. Ravindran A. and      Operations Research, Principles and Practice  
           Solberg. J.
- (iv)    Churchman C.W. Ackoff R.L.      Introduction to Operations Research  
           And Arnoff E.L. (1957)
- (v)     Johan Wiley Hadley, G. (1987)      Linear Algebra Narosa Publishing House.

**M.Sc./M.A. (STATISTICS )**  
**Third Semester**  
**STOCHASTIC PROCESS**  
**PAPER-I**

- UNIT-I Introduction to stochastic process Classification, Markov Chain, Transition probability matrix, Chapman-Kolmogorov equation  $n^{\text{th}}$  order transition probabilities (multiplication of matrices, spectral decomposition, generating function) and its limiting behaviour.
- UNIT-II Stationary distribution, Stationary distribution for irreducible aperiodic markov chain, Ergodic theorem, Criterion for transience, Existence of stationary distribution, Stability of Markov system, classification of states and chains.
- UNIT-III Reflecting and absorbing barrier in Random walk model, Gambler ruin problem, Limiting case, Poisson process, pure birth process, Pure death process.
- UNIT-IV Discrete state space continuous time Markov chain, Wiener Process: Concept, Wiener process as approximation to normal distribution, Distribution of first passage time, Renewal Process (aiscgete case)

**Book for reference:**

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|-------|---|--|
| (i)   | B.R. Bhatt                                      | Stochastic Models Analysis and Applications.   |
| (ii)  | K.L. Chung (1967)                               | Malkov Chains with Stationary Transition prob. |
| (iii) | J. Medhi (1982)                                 | Stochastic Process                             |
| (iv)  | S.K. Srinivasan, K.M. Mehata (T.M.H. New Delhi) | Stochastic Process.                            |

**M.Sc./M.A. (STATISTICS )**  
**Third Semester**  
**MULTIVARIATE ANALYSIS-I**  
**PAPER-II**

- UNIT-I      Bivariate and Multivariate Normal Distributions-0 Marginal and conditional distribution and their properties, Characteristic function.
- UNIT-II      Maximum likelihood estimates of mean vector and covariance matrix, Distribution of sample mean vector, tests and confidence region for mean vector when covariance is known, Comparing mean vectors of two normal distributions, Sufficient Statistics for  $\mu$  and  $\Sigma$ .
- UNIT-III     Wishart's distribution and its reproductive property, Hotelling's  $T^2$  and its sampling distribution, optimum properties of  $T^2$ , Application in test on mean vector for one and more multivariate normal population and also on equality of components of mean vector in multivariate normal distribution, Mahalanobis's  $D^2$ .
- UNIT-IV     Principal Components: Definition of principal components in the population, Maximum likelihood estimators of the principal components and their variances, Computation of the maximum likelihood estimates of the principal components.

**Book for reference:**

- |       |                |  |
|-------|----------------|--|
| (i)   | Anderson T.W.  | Introduction to Multivariate Statistics          |
| (ii)  | Rao C.R.       | Linear Statistical Inference and its application |
| (iii) | Giri N.C.      | Multivariate Statistical Inference               |
| (iv)  | Khirsagar A.M. | Multivariate Analysis                            |
| (v)   | Morrison D.F.  | Multivariate Analysis.                           |

**M.Sc./M.A. (STATISTICS )**  
**Third Semester**  
**STATISTICAL INFERENCE**  
**PAPER-III**

- UNIT-I            Generalization of N.P. Lemma, likelihood ratio and its properties, monotone likelihood ratio families, U.M.P. tests for one and two sided hypothesis for one parameter exponential family.
- UNIT-II            Unbiased test and Locally unbiased most powerful tests. Construction of M.P. and U.M.P. critical regions sampling from normal POPULATION, Test having Neyman Structure, Invariant test, Admissibility.
- UNIT-III           Properties of exponential distribution, Estimation of mean life with complete and censored samples in exponential model, Estimation of parameter in Weibull distribution, Reliability estimation.
- UNIT-IV           Mixture of exponential and Weibull, Maximum likelihood estimators of parameters, Tests of hypothesis and confidence Intervals for exponential and normal distribution.

**Book for reference:**

- |       |                        |  |
|-------|------------------------|--|
| (i)   | Lehmann                | Testing of Statistical Hypothesis          |
| (ii)  | Goon, Gupta, Das Gupta | An outline of Statistical Theory (Vol. II) |
| (iii) | Sinha S.K.             | Reliability and Life Testing               |
| (iv)  | Hogg and Crag          | Probability and Statistical Inference.     |

**M.Sc./M.A. (STATISTICS )**  
**Third Semester**  
**ECONOMETRICS**  
**PAPER-VI**

- UNIT-I      Simple and Multiple linear regression model, General linear regression model, least square estimators and its properties, prediction, Correlation matrix, partial and multiple correlation coefficient, Multicollinearity and its consequences, Tests for detecting multicollinearity, methods for removing multicollinearity.
- UNIT-II      Generalized least square estimators and its properties, Heteroscedasticity and its consequences, Tests for Heteroscedasticity, Different heteroscedastic structure, Autocorrelation, Coefficient of autocorrelation, mean/variance and covariance of disturbance term in autocorrelated model, effect of autocorrelation of OLS estimators, Test for autocorrelation.
- UNIT-III     Simultaneous equation model, Inconsistency and simultaneity bias of OLS estimator, Types of model in simultaneous equation, Estimation method: Indirect Least Square (ILS), Two stage least square (2 SLS), Limited information maximum likelihood (LIML)
- UNIT-IV     Identification, Problem of identification, over and under identification, rank and order condition of identification.

**Book for reference:**

- |       |                  |  |
|-------|------------------|--|
| (i)   | G.M.K. Madnani   | Introduction to Econometrics, Oxford & IBH Publishing Co.        |
| (ii)  | Apte P.G. (1990) | Text book of Econometrics Tata- McGraw –Hill Publishing Co. Ltd. |
| (iii) | Gujarathi D      | Basic Econometrics, McGraw-Hill                                  |
| (iv)  | Kotsoyiannis, A  | Theory of Econometrics, Mcmillan Press                           |
| (v)   | J. Johnston      | Econometrics Method, 3 <sup>rd</sup> Edition Macgraw-Hill        |

PRACTICAL : Based on Paper X, XI and XII

**M.Sc./M.A. (STATISTICS )**  
**Fourth Semester**  
**APPLIED STOCHASTIC MODELS**  
**PAPER-I**

- UNIT-I      Renewal theory (Continuous time) : renewal function, number of renewals and renewal equation, Wald's equation, asymptotic normality of the number of renewals, elementary renewal theorem.
- UNIT-II      Fertility models: Determinants of birth intervals, Stochastic models for birth intervals and number of births and estimation of parameters.
- UNIT-III     Branching Process : Generating function and its recurrence relations, Mean and variance of  $n^{\text{th}}$  generation, Probability of ultimate extinction.
- UNIT-IV     Queueing theory : Kendall notation, M/M/1 queues, Derivation of probability distribution size of the system, size of queue using differential equation of birth-death process in steady state, Distribution of waiting time in queue and system, Mean and variance of size of the queue, system, waiting time.

**Book for reference:**

- |       |                                      |  |
|-------|--------------------------------------|--|
| (i)   | Medhi, J. (1982)                     | Stochastic Processes, Wiley Eastern  |
| (ii)  | Ross, S.M. (1983)                    | Stochastic Processes, Wiley  |
| (iii) | Bhat, B.R. (2000)                    | Stochastic Models: Analysis and Application, New International Publications.   |
| (iv)  | K.B. Pathak and Arvind Pandey (1993) | Stochastic models of Human Reproduction, Himalaya Publishing House, New Delhi. |

**M.Sc./M.A. (STATISTICS )**  
**Fourth Semester**  
**MULTIVARIATE ANALYSIS-II**  
**PAPER-II**

- UNIT-I      Test of independence sets of normal variate- The likelihood ratio criterion for testing independence of set of variates- Moments of the likelihood ratio criterion under the null hypothesis, Test for independence of two sets of random variables and associate confidence bound, Comparison of dispersion matrices of two normal distributions, Comparison of the mean vectors of K normal distributions.
- UNIT-II      Discriminant functions- Test for discriminant function, Multiple correlation coefficient and its distribution when population multiple correlation coefficient is zero, Partial correlation coefficient, Tests of hypothesis and confidence Regions for partial correlation coefficient.
- UNIT-III     Classification: The problem of classification, Standard of good classification, Procedure of classification into one of two population with known probability distribution, Classification into one of two known multivariate normal population, Classification into one of several populations, Classification into one of several multivariate normal populations, Likelihood ratio criterion for classification, Criterion of classification when parameters are estimated.
- UNIT-IV     Canonical correlation and variables in the population, Estimation of canonical correlation and variates, Distribution of canonical correlations, Factor Analysis.

**Book for reference:** Some as prescribed for Paper X.

**M.Sc./M.A. (STATISTICS )**  
**Fourth Semester**  
**SEQUENTIAL ANALYSIS AND DECISION THEORY**  
**PAPER-III**

- UNIT-I      Motivation for sequential analysis, construction of a sequential probability ratio tests (SPRT) and its properties, Determination of A and B, Derivation of O.C. and A. SN. Functions. Mortingate sequence.
- UNIT-II      Efficiency of SPRT, Testing of mean of a Bionomial distribution, Testing the difference between the means of two Bionomial distributions, Testing the mean of a normal distribution with known S.D. and testing the S.D. of a normal distribution, Stein's two stage sampling. .
- UNIT-III     Elements of decision theory- Loss function, risk function, Minimax approcha and Boyes approach, Structure of Boyes rules, Complete class rule, construction of minimax rules, Bayes and invariant estimates, conves loss function, Rule of sufficiency. .
- UNIT-IV     Point Estimation as decision problem, Interval estimation as a decision problem, Hypothesis testing as a decision problem, Problem of classification.

**Book for reference:**

- |       |                        |   |
|-------|------------------------|---|
| (i)   | A. Wald                | Sequential Analysis                         |
| (ii)  | Goon, Gupta, Das Gupta | An out line of Statistical Thoery (Vol. II) |
| (iii) | T.S. Ferguson          | Mathematical Statistical Decision Theory    |



**M.Sc./M.A. (STATISTICS )**  
**Fourth Semester**  
**TIME SERIES ANALYSIS**  
**PAPER-IV**

- UNIT-I      Definition and concept, Time series as a discrete parameter stochastic process, Its various components, Auto covariance and autocorrelation function and their properties, Logistic curve and various methods for its fitting, Properties of logistic curve.
- UNIT-II      Exploratory time series analysis, Tests for trend and seasonality, Exponential and moving average smoothing, forecasting based on smoothing.
- UNIT-III     Stationary time series, Measurement of cyclic component, Harmonic analysis, Periodogram analysis, Auto regression series, Markoff's Series and Yule's series and its solution.
- UNIT-IV     Auto Covariance and autocorrelation function, Correlogram of moving average, Correlogram of first and second order auto regression series.

**Book for reference:**

- |       |                             |  |
|-------|-----------------------------|--|
| (i)   | T.W. Anderson               | Statistical analysis of time series  |
| (ii)  | M.G. Kendall and A Stuart   | The Advanced Theory of Statistics,<br>(Vol. III)                             |
| (iii) | P.J. Brockwell & R.A. Davis | Time series: Theory and Methods 2 <sup>nd</sup><br>Edition, Springer Verlag) |
| (iv)  | S.C. Gupta & V.K. Kapoor    | Fundamental of applied Statistics  |
| (v)   | Goon, Gupta & Dasgupta      | Fundamental of Statistics (Vol. II)  |

PRATICAL :    Based on Paper XIV, XV and XVI.