SRI VENKATESWARA UNIVERSITY :: TIRUPATI

SVU COLLEGE OF SCIENCES
Department of Statistics

Re-Structured P.G. Programme (CBCS) as per NEP 2020, National Higher Education Qualification Frame Work (NHEQF) and Guidelines of APSCHE

(With effect from the batch of Students admitted from the academic year 2024-25)

MASTER OF SCIENCES (Applied Statistics)

SEMESTER - I								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	101	Probability and Distributions	4	4	70	30	100
2		102	A. Measure Theory and Linear Algebra B. Financial Statistics	4	3	50	25	75
3		103	A. Advanced Survey Sampling Theory B. Statistical Methodology	4	3	50	25	75
4	*P	104	Practical-I (APST 102 & APST 103)	6	2	35	15	50
5	SOC	105	A. Statistical Analysis using SPSS and Excel B. Statistical Computing and Data Analysis	4	3	50	25	75
6		106	A. Applied Stochastic Process and Review Theory B. STATISTICAL COMPUTING	4	3	50	25	75
7	*P	107	Practical-II(APST 105 & APST 106)	6	2	35	15	50
			Total	**36**	**20**	**340**	**160**	**500**
8	Audit Course	109	Research Methodology	4	0	0	100	0

- **CC (Core Courses) - 1st Core Course is mandatory and 2nd & 3rd Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Practical – I relating to 2nd & 3rd Core Courses and Practical - II relating to 1st & 2nd Skill Oriented Courses (SOC)**

Audit Course – Zero Credits but mandatary with only a Pass

APST 101: PROBABILITY AND DISTRIBUTIONS

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, Lebesgue and Lebesgue-Stieltjes measures, Measurable functions, Random variables, sequence of random variables, almost sure convergence, convergence in probability (and in measure). Monotone convergence theorem, Fatou's lemma, Dominated convergence theorem.

Unit-II: 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), convergence in distribution.

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

References

1. Ash, Robert. (1972). Real Analysis and Probability. Academic Press.
2. Billingsley, P. (P. (1986) Probability and Measure. Wiley.
3. Kingman, J F C and Taylor, S. J. (1966). Introduction to Measure and Probability. Cambridge University Press.
4. Loeve, M (1963), Probability theory
5. Bhatt B.R (1998), Modern Probability theory, Wiley Eastern
6. Rohatgi V.K. (1984): An Introduction to probability theory and mathematical Statistics.

7. Rao C.R (1973): Linear Statistical Inference and its Applications, 2/e, Wiley Eastern.
8. Pitman J. (1993): Probability, Narosa Publishing House.
9. Johnson, N.L and Kotz, S.M. (1972): Distributions in Statistics, Vol. I , II & III. Houghton and Miffin.
10. David H.A (1981): Order Statistics, II Edition, and John Wiley.
11. Feller W (1966): Introduction to probability theory and its applications, Vol. III, second edition. Wiley Eastern.

<table>
<tr><td>Subject Code</td><td>Subject Name</td><td colspan="2">Credits Allotted</td><td>Total</td></tr>
<tr><td rowspan="2">APST-101</td><td rowspan="2">Probability and Distributions</td><td>Theory</td><td>Practical</td><td rowspan="2">4</td></tr>
<tr><td>4</td><td>---</td></tr>
<tr><td>Course Objective</td><td colspan="4">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.
4. To explain about different discrete and continuous distributions and their Properties.
5. To learn about derivations and properties of various sampling distributions.
6. To explain order Statistics and their properties</td></tr>
<tr><td>Course Out comes</td><td colspan="4">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 know about different continuous and discrete distributions and their properties.
4. They have awareness about central and non central sampling distributions and order Statistics. Idea about simple, partial and multiple correlation coefficients.</td></tr>
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APST-102(A): Measure Theory and Linear Algebra

Unit–I

Field and Sigma Field. Measure and Probability Measure. Outer Measurability of Sets. Class of Measurable Sets. Construction of Outer Measure using Sequential Concerning Classes. Lebesgue Measure. Construction of Non-Measurable Sets.

Unit–II

Measurable Function as a Random Variable. Simple Functions. Sequences and Algebra of Measurable Functions. Approximation Theorem of Measurable Functions. Concepts of Almost Everywhere (a.e) and Almost Uniform Convergence. Egoroffs Theorem. Lusin Theorem.

Unit–III

Convergence in Measure. Fundamental in Measure. F.Riesz Theorem for Convergence in Measure.Integral of a Measurable Function w.r.t a Measure. Bounded Convergence Theorem. Fatou's Lemma, Monotone Convergence Theorem. General Lebesgue Integral and Lebesgue Dominated Convergence Theorem.

Unit–IV

Linear and Orthogonal Transformation of a Matrix. Eigen Values and Eigen Vectors of a Liner Transformation. Quadratic Forms and Their Reduction to Canonical Form. Signature of a Matrix. Positive Definite Matrix.

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.
6. Biswas, S. (1984), Topics in Algebra of Matrices, Academic Publications.
7. Hadley, G. (1987), Linear Algebra, Narosa Publishing House.
8. Halmos, P.R. (1958), Finite-dimensional Vector Spaces 2nd ed. D.Van Nostrand Company, Inc.

9. Hoffman, K. and Kunze, R, (1971). Linear Algebra, 2nd ed., Prentice Hall
10. Rao, A.R. and Bhimasankaram, P. (1992), Linear Algebra, Tata McGraw Hill Publishing Company Ltd.
11. Rao, C.R. and Mitra, S.K. (1971), Generalized Inverse of Matrices and its Applications, John Wiley and Sons, Inc.
13. Narayan, S. (1970), Theory of Matrices, S. Chand &Company, New Delhi.

Subject Code	Subject Name	Credits Allotted		Total
APST-102(A)	**Measure Theory and 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			
Course Out comes	Students understood for estimation of elementary transformations in matrix and their solutions. Students learnt about characteristic roots and vectors with numerical examples. They also know theoretical proofs of theorems.			

APST-102(B): Financial Statistics

Unit -I: Review and Extensions- Assets, Portfolios and Arbitrage, Derivatives, Pricing, Hedging, Greeks, Discrete Time Models, Continuous Time Models, Random walk, Geometric Random Walk, Brownian Motion, Wiener Process.

Unit -II: Review and Extensions- Stochastic Calculus, Stochastic Differential Equations, Partial Differential Equations, Black- Scholes' PDE, Martingales and their Applications in Pricing of Assets, Plain Vanilla Options, Greeks of Plain Vanilla Options, Estimation of Volatility, CRR Model.

Unit- III: Financial Markets Instruments- Exotic Options, Reflection Principle, Asian Options, Change of Numeraire, Pricing of Exchange Options, Forward Rates Modelling, Forward Vesicek Rates, Interest Rates Derivatives and their Pricing, Default Risk in Bond Markets, Credit Default Swaps.

Unit-IV: Jump Processes- Poisson Process, Compound Poisson Processes, Stochastic

Integrals with Jumps, Itô- Integral with Jumps, Stochastic Differential Equations with Jumps, Girsanov Theorem for Jumps Processes, Lèvy Processes, Pricing and Hedging in Jump Processes, Risk Neutral Measures, Black Scholes' PDE with jumps.

References

1. Lamberton, D. and Lepeyre, B. (2008). Introduction to Stochastic Calculus Applied to Finance, 2nd ed., Chapman and Hall/CRC Press.

2. Privault, N. (2014). Stochastic Finance –An Introduction with Market Examples, Chapman and Hall/CRC. Financial Mathematics Series, CRC Press, Boca Raton, 2014.

3. Tankov, P. (2010). Financial Modeling with Lèvy Processes, e-Book.

Course Objectives: Financial Statistics aims to introduce students to the market tools required for analyzing the financial markets, to model various financial instruments and to find solutions of the problems faced by various players of these markets.

Course Learning Outcomes:

After successful completion of this course, student will be able to:

1. Understand the intricacies of the derivatives markets and analyse them quantitatively.
2. Model and analyze the jumps observed in security markets.
3. Take up research to be able to attempt to fill the gap between the markets and academics.

APST 103(A): Advanced Survey Sampling Theory

Unit I: Admissibility of Estimators; Non-existence of UMV estimators; Estimation of Median; Sampling on two or more successive occasions (Repetitive surveys); Re-Sampling techniques for variance estimation-independent and dependent random groups, the Jackknife and the Bootstrap.

Unit II: Small-area estimation; Design-based conditional approach; Double sampling for stratification.

Unit III: Non-sampling errors; Non-response and missing data; Randomized Response Techniques for one quantitative sensitive characteristic. Prediction of non-observed residual under fixed (design-based) and super-population (model-based) approaches.

Unit IV: Model-assisted sampling strategies; Different types of Super-population models with optimal strategies based on them; Robustness against model failures.

References

1. Cassel, C.M., Sarndal, C-E and Wretman, J.H. (1977). Foundations of Inference in Survey Sampling, John Wiley & Sons.

2. Chaudhari, A. and Stenger, H. (2005). Survey sampling Theory and Methods, 2nd ed., Chapman and Hall.
3. Hedayat, A.S. and Sinha, B.K. (1991). Design and Inference in Finite Population Sampling, John Wiley & Sons.
4. Muhopadhyay, P. (2007). Survey Sampling, Nerosa Publishing House, New Delhi.
5. Mukhopadhyay, P. (1996). Inferential Problems in Survey Sampling, New Age International (P) Ltd.
6. Levy, P.S. And Lemeshow, S. (2008). Sampling of Populations-Methods and Applications, John Wiley & Sons.
7. Sarndal, C.E., Swensson, B. and Wretman, J.H. (1992). Model Assisted Survey Sampling, Springer-Verlag.
8. Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C. (1984). Sampling Theory of Surveys with Applications, Iowa State University Press, Iowa, USA.
9. Wolter, K.M. (2007). Introduction to Variance Estimation, Springer-Verlag.

Course Objectives: The objective of this course is to provide advanced techniques in survey sampling with practical applications in daily life and to provide accessible statistical tool for applying sampling strategies and methodologies.

Course Learning Outcomes:

After successful completion of this course, student will be able to:

1. Understand the non –existence of uniform estimators and repetitive surveys.
2. Apply the re-sampling techniques for variance estimation – independent and dependent random groups.
3. Understand the design based estimation procedures and double sampling technique for stratification.
4. Understand the response and non- response techniques; Randomized Response Technique and a technique to predict non observed residue under design and model based model.
5. Understand the model assisted sampling strategies; super population model.

APST 103(B): Statistical Methodology

Unit I: Brief review of basic distribution theory, Symmetric distributions, Truncated distributions, Compound distributions, Mixture of distributions, Generalized power series distributions, Exponential family of distributions.

Unit II: Characterization of distributions (Geometric, negative exponential, normal, gamma), Non-central Chi-square, t and F distributions and their properties, Concept of censoring. Approximating distributions, Delta method and its applications, Approximating distributions of sample moments, Limiting moment generating function, Poisson approximation to negative binomial distribution.

Unit III: Order statistics-their distributions and properties. Joint and marginal distributions of order statistics. Extreme values and their asymptotic distributions (statement only) with applications. Tolerance intervals, coverage of (X(r), X(s)). General theory of regression, fitting of polynomial regression by orthogonal methods, multiple regression, examination of regression equation.

Unit IV: Robust procedures, Robustness of sample mean, Sample standard deviation, Chisquare test and Student's t-test. Sample size determination for testing and estimation procedures (complete and censored data) for normal, exponential, Weibull and gamma distributions.

References:

1. Arnold, B.C., Balakrishnan, N., and Nagaraja, H.N. (1992). A First Course in Order Statistics, John Wiley & Sons.
2. Biswas, S. (1992). Topics in Statistical Methodology, Wiley-Blackwell.
3. David, H.A., and Nagaraja, H.N. (2003). Order Statistics, 3rd Edn., John Wiley & Sons.
4. Dudewicz, E.J. and Mishra, S.N. (1988). Modern Mathematical Statistics, Wiley, International Students' Edition.
5. Huber, P.J. (1981). Robust Statistics, John Wiley & Sons.
6. Johnson, N.L., Kotz, S. and Balakrishnan, N. (2000). Discrete Univariate, John Wiley & Sons.
7. Johnson, N.L., Kotz, S. and Balakrishnan, N. (2000). Continuous Univariate Distributions, John Wiley & Sons.
8. Mukhopadhyay, P. (2015). Mathematical Statistics. New Central Book Agency.
9. Rohatgi, V.K. and Saleh, A. K. Md. E. (2005). An Introduction to Probability and Statistics, 2nd Edn., John Wiley & Sons.
10. Rohatgi, V.K. (1984). Statistical Inference, John Wiley & Sons.
11. Rao, C.R. (1973). Linear Statistical Inference and Its Applications, 2nd Edn., John Wiley & Sons.

Course Objective: The aim of this course is to provide a thorough theoretical grounding in different type of distributions, non-central distributions, censoring, delta method, robust procedures etc.

Course Learning Outcomes:

After successful completion of this course, student will be able to:

1. Formulate the mathematical/statistical models for real data sets arising in various fields in order to analyse in respect of various useful characteristics of the populations.
2. Understand how to use non-central distributions in real life problems.
3. Understand different types of censoring schemes.
4. Work with incomplete data which is a challenging problem in today's life.

APST 104: Practical-I (APST 102 & APST 103)

APST 105(A): Statistical Analysis using Excel and SPSS

Unit-I: 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-II: 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-III: 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, 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-IV: Using SPSS 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.

APST 105(B): Statistical Computing and Data Analysis

Unit-I: Review of programming in C: Operators & expressions; Flow control; Functions; Arrays;

Strings; Pointers; Structures. Computer representation of numbers, Errors. Bitwise operations. The C Preprocessor, Macros. Linked Lists; Stacks & Queues. Sorting – Introduction, bubble sort, selection sort, insertionsort, quick sort.

Unit_II: Random numbers: Pseudo-Random number generation, tests. Random variable generation,Inverse-Transform method, Composition Method, Acceptance-Rejection Method. Generating discrete and continuous random variables.

Unit-III: Simulation- Random Walk. Applications relating to the problems based on other courses viz., Probability Theory, Statistical Methodology, Survey Sampling.

Unit – IV: Data Analysis

Computer-based data analysis of problems.

References

1. Gottfried, B.S. and Chhabra, J.K. (2006). Programming with C, Tata McGraw Hill Publishing Co. Ltd., New Delhi (SIE).

2. Knuth, D.E. (2002). The Art of Computer Programming, Vol. 2/Semi numerical Algorithms, Pearson Education (Asia).

3. Kernighan, B.W. and Ritchie, Dennis M. (1989). The C Programming Language, Prentice Hall of India Pvt. Ltd., New Delhi.

4. Rubinstein, R.Y. (2017). Simulation and the Monte Carlo Method, 3rd ed., John Wiley & Sons.

5. Ross, S.M. (2012). Simulation, 5th ed., Academic press.

6. Thareja, R. (2014). Data Structures using C, Oxford University Press, New Delhi, India.

List of Practicals:

1. Study of convergence of sequence through plotting.

2. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.

3. Evaluating line integral and multiple integral.

4. Program to discuss the algebra of complex numbers.

5. To perform contour integration.

6. To plot the complex functions and analyse the graph.

7. To perform Taylor series and Laurent's series expansion of a given function f(z) around a given point z.

8. To compute poles and corresponding residue of complex function of sets.

9. To examine whether a given function is measurable or not.

10. To find out Lebesgue- Stieltjes measure of a given real valued function of a real variable.

11. To find out marginal distribution function of random variables X and Y when some distribution function f(X,Y) is given.

12. To check a sequence of set for convergence and to find out limit of the sequence if exists.

13. To find the limit inferior and limit superior of a given sequence of sets.

14. To check whether a given sequence of random variables {Xn} is uniformly integrable or not.

15. For a sequence of random variables check whether E (lim Xn) = lim E(Xn) holds or not.

16. Problems based on censoring.

17. Problems based on maximum likelihood estimation.

18. Problems based on tolerance intervals.

19. Random number generation from non-central Chi square distribution.

20. Random number generation from non-central t-distribution.

21. Random number generation from non-central F-distribution.

22. Problems based on sample size determination for testing.

23. To select simple random Sample with and without replacement and estimate population mean and population variance for a given sample size.

24. To select Stratified Random Sample for a given population.

25. Allocation of sample using proportional and Neyman method of allocation and comparing their efficiencies relative to SRS.

26. Systematic Sampling.

27. To estimate population mean in case of sampling with varying probabilities of selection.

28. Cluster Sampling.

29. Two- stage Sampling.

APST 106(A): Applied Stochastic Process and Review Theory

UNIT -I

Introduction to stochastic process (SP) – classification of SP according to state space
and time domain. countable state markov chain (MC). Chapman-Kolmogorov
equations. Calculation of 'n' step transition probability.

UNIT -II

Discrete state space – continuous time MC. Kolmogorov differential equations.
Poisson process, birth and death process .Application to queues and storage problem.
Random walk.

UNIT -III

Markov process – continuous time and continuous state space - time homogenous
markov process – Kolmogorov's equation. Wiener process as a limit of random walk,
first passage time Diffusion process with Wiener process.

UNIT -IV

Stationary process and time series- wide sense and strict sense stationary process –
moving average and auto regressive process. Covariance function - Bochner's
function (statement), Khintchine's representation of wide sense stationary process.
Renewal theory – renewal function and its properties – Elementary and key renewal
theorems.

References

1. Medhi.J. (1982) Stochastic process, Wiley Eastern.
2. Basu. A.K. (2003) Introduction to stochastic processes, Newsa Publishing House.
3. Ross. S.M. (1983) Stochastic Process, Wiley, New York.
4. Karlin and First course in Stochastic Process-Vol.I&II, Academic

Press. Taylor.H.M. (1975)

APST 106(B): STATISTICAL COMPUTING

UNIT- I

Object Oriented Programming (OOPs) Paradigm – Basic Concepts of OOPs – Object
Oriented Languages. A Simple C++ Program – More C++ Statements – Structure of
C++ Program. Tokens, Keywords – Identifiers and Constants – Basic Data Types –
User-defined Data Types – Operator in C++ – Scope Resolution Operator – Expressions
and their Types – Control Structures.

UNIT -II

Functions in C++: Introduction – The main function – Function Prototyping – Inline
Functions – Default Arguments – Function Overloading – Math Library Functions.
Classes and Objects: Specifying a Class – A C++ Program with Class – Defining
Member Functions – Nesting Member Functions – Private Member Functions – Arrays
within a class – Friendly functions – Memory Allocation of Objects – Array of Objects –
Local Classes.

UNIT -III

Constructors – Copy Constructor – Dynamic Constructors – Constructing Twodimensional
Arrays, Destructors. Operator Overloading – Introduction – Defining
Operator Overloading – Overloading Unary Operators – Overloading Binary Operators
– Rules for Overloading Operators. Function Overloading – Function Overloading with
Arguments – Special Features of Function Overloading.

UNIT - IV

Inheritance: Introduction – Types of Base Classes – Types of Derivation – Public –
Private – Protected – Defining Derived Classes –Single Inheritance – Making a Private
Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical
Inheritance – Hybrid Inheritance – Polymorphism – Introduction – Virtual Functions.
Managing Console I/O Operations: C++ Streams – C++ Stream Classes – istream,
ostream, iostream, fstream, ifstream, ofstream, filebuff. Unformatted I/O Operations
– Formatted I/O Operations –Managing output with Manipulators. Classes for File
Stream Operations – Opening and Closing a file – Detecting end-of-file.

References:

1. E. Balagurusamy: Object Oriented Programming with C++, Tata McGraw-Hill
Publishing
Company Limited, New Delhi, 4th Edition, 2008.

APST 107: Practical-II (APST 105 & APST 106)

APST 108: OOTC

APST 109: Research Methodology

UNIT – I: Introduction to Research:

Meaning and importance of Research, Types of Research, Research Design and Stages Selection and Formulation of Research Problem, Objective(s) and Hypothesis Developing Research Plan – Exploration, Description, Diagnosis, Experimentation, Determining Experimental and Sample Design.

Data Collection: Sources of Data – Primary and Secondary, Types of Data – Categorical (nominal and ordinal), Numerical (discrete, continuous, ratio and interval) Methods of Data Collection: Survey, Interviews (in-depth or Key Informant interviews), Focus Group Discussion (FGD), Observation, Records or Experimental Observations.

UNIT – II: Data Processing and Analysis:

Statistical Graphics – Histograms, Frequency Polygon, Ogive, Dotplots, Stemplots, Bar Graphs, Pareto Charts, Pie Charts, Scatterplots, Boxplots Descriptive Analysis – Frequency Distributions, Measures of Central Tendency, Measures of Variation/Dispersion, Skewness and Kurtosis, Measures of Relative Standing Qualitative Approaches Including Grounded Theory, Ethnography, Narrative Inquiry, Phenomenology and Case-Study.

UNIT – III: Scientific Writing & Research Ethics:

Structure and Components of Scientific Reports – Types of Report – Technical Reports and Thesis – Significance – Different steps in the preparation – Layout, Structure and Language of Typical Reports – Illustrations and Tables – Bibliography, Referencing and Foot Notes.

UNIT-IV: Preparation of the Project Proposal

Title, Abstract, Introduction – Rationale, Objectives, Methodology – Time frame and Work Plan – Budget and Justification – References. Research Ethics Committees/Institutional Review Board – Roles and Importance Intellectual Property rights – Commercialization, Royalty Reproduction of Published Material – Citation and Acknowledgement, Plagiarism.