MASTER OF SCIENCES
STATISTICS

SYLLABUS & REGULATIONS

WITH EFFECT FROM 2025-26

M.Sc. STATISTICS

P.G. Degree Programme (CBCS) Regulations-2016
Amended as per NEP-2020&CHOICE BASED CREDIT SYSTEM (CBCS)

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)
SRI VENKATESWARA UNIVERSITY
Accredited by "NAAC" with A+ Grade
Tirupati, Andhra Pradesh – 517502

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)
SRI VENKATESWARA UNIVERSITY::TIRUPATI
S.V.U.COLLEGE OF SCIENCES

DEPARTMENT OF STATISTICS

(Revised Scheme of Instruction and Examination, Syllabus etc., (with effect from the Academic Years 2024-2025)

M.Sc. STATISTICS

Semester-I

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	ST - 101	Core	Probability and Distributions	6	4	**30**	**70**	100
2	ST - 102	Core	Algebra	6	4	**30**	**70**	100
3	ST - 103	Core	Sampling Techniques	6	4	**30**	**70**	100
4	ST - 104	Compulsory Foundation	Statistical Analysis using SPSS and Excel **Computer Programming**	6	4	**30**	**70**	100
5	ST - 105	Core	Discrete Mathematics	6	4	**30**	**70**	100
6	ST - 106	Practical	Practical-I (75 Practical + 25 Record)	9	4	-	-	100
	Total			**42**	**24**			**600**

SEMESTER-II

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	ST - 201	Core	Statistical Inference	6	4	**30**	**70**	100
2	ST - 202	Core	Operations Research	6	4	**30**	**70**	100
3	ST - 203	Optional	(a) Linear Models and Applied Regression Analysis **b. Python**	6	4	**30**	**70**	100
4	ST - 204	Core	Statistical Process and Quality Control	6	4	**30**	**70**	100
5	ST - 205	Core	**Analysis**	6	4	**30**	**70**	100
6	ST - 206	Practical	Practical-II (75 Practical + 15 Viva- voce + 10 Record)	9	4	-	-	100
	Total			**42**	**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	ST - 301	Core	Econometric Methods	6	4	**30**	**70**	100
2	ST - 302	Core	Multivariate Analysis	6	4	**30**	**70**	100
3	ST - 303	Core	Practical-III (75 Practical + 25 Record)	9	4	-	-	100
4	ST - 304	Generic Elective * **(Related to Subject)**	(a) Demography and Official Statistics (b)Bio-Statistics	6	4	**30**	**70**	100
5	ST-305 Skill Oriented Course	Mandatory (Theory + Practical-VI)	Statistical Analysis Using R + R Practicals	9 (3+6)	4	10	90 (40+50)	100
6	ST - 306	Open Elective **(For other Department)**	(a) Statistics for Biological and Earth Sciences (b) Statistics for Social and Behavioral Sciences	6	4	**30**	**70**	100
	Total			**42**	**24**			**600**

*** Among the Generic Electives the student shall choose <u>ONE</u>**

****Open Elective papers is for other department**

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	ST - 401	Core	Time Series Analysis and Forecasting Methods	6	4	**30**	**70**	100
2	ST - 402	Core	Industrial Statistics and Quality Control	6	4	**30**	**70**	100
3	ST - 403	Generic Elective * **(Related to Subject)**	(a)Advanced Econometric Models (b) Total Quality Management and Six - Sigma	6	4	**30**	**70**	100
4	ST - 404	Core	Practical-IV (75 Practical + 15 Viva-voce + 10 Record)	9	4	-	-	100
5	ST - 405	Project Work / Multidisciplinary (Theory + Practical-VIII)	**Student Project:** Data Centre / Institutions / Companies and etc., (or)Statistical Process and Quality Control(Theory+ Practical)	9=3T +6P	4	-	-	100
6	ST - 406	Open Elective **(For other Dept.)**	(a) Business Analytics (b) Survival Analysis	6	4	**30**	**70**	100
	Total			**42**	**24**			**600**

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DEPARTMENT OF STATISTICS

M.Sc. STATISTICS

Semester-I

ST-101 :Probability and Distributions

Unit-I: Classes of sets, fields, σ -fields, minimal σ -field, Borel σ – field in RK, 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 $\chi 2$; Fisher's Z-distribution, fisher's Ztransformation. 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
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.

ST- 102 : ALGEBRA

Algebra is one of the broad areas of Mathematics together with Number theory Geometry and analysis. Algebra is applicable to all mathematical domains.

Course objectives:

1. To introduce the basic structures of Algebra such as groups, rings, fields and Domains which are pillars of modern mathematics
2. To develop working knowledge on Sylow's theorems
3. Provide information on Ideals and homomorphism.
4. Discuss U.F.D, E.D and polynomial Rings.

UNIT –I:

Cyclic groups - Conjugacy and G-Sets, Permutation groups-Cyclic decomposition-Alternating Group A_n-Simplicity of A_n.(Section 4 of Chapter 4, Sections 4 of Chapter5, Sections 1, 2 and 3 of chapters 7).

UNIT –II:

Structure Theory of Groups: Direct Products –Finitely generated abelian groups -Invariants of a finite abelian group –Sylow theorems –group of orders p2, pq.(Section 1,2,3,4 and 5 of Chapter 8).

UNIT – III:

Ideals and Homomorphism's: Ideals – Homomorphism's –Sum and direct sum of ideals – Maximal and prime ideals – Nilpotent and nil ideals –Zorn's Lemma(Chapter 10)

UNIT – IV:

Unique Factorization domains and Euclidean Domains: Unique factorization domains-Principal ideal domains-Euclidean domains, Polynomial rings over UFD.(Chapter 11)

Scope and standard in the book **"Basic Abstract Algebra" by P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Cambridge University Press, Reprint 1997.**

References:

(1) Topics in Algebra, by I.N. Herstein

(2) Commutative algebra, by Zariski and Samuel Affiliated East-West Press.

(3) Abstract Algebra – Ronald. Solomon.

(4) A First course in 'ABSTRACT ALGEBRA' seventh edition by John B. Fraleigh, Pearson Education.

(5) Abstract algebra by David S. Summit, Richard .M.Forte, Wiley publication, 3rd edition.

(6) Introduction to rings and modules by C.Musli, Narosa Publications.

(7) A first course in abstract algebra by John B Fraleigh.

(8) Basic algebra by Jacobson.Nathan ,Vol 1, Hindustan Publishing corporation 1991

Course outcomes: After completing this course the student will be able to

1. Identify the concept of action and conjugation.
2. Solve the problems on homomorphism, Permutations and cyclic groups
3. Analyze the maximal, prime, nilpotent and Nil ideals.
4. Explain the applications of Sylow's theorems
5. Understand U.F.D,E.D and Polynomial Rings

ST -103: 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. MukhopadhyayP(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.

ST- 104: Computer Programming

UNIT-I

OBJECT ORIENTED THINKING AND JAVA BASICS

Object oriented thinking and Java Basics- Need for oop paradigm, summary of oop concepts, coping with complexity, abstraction mechanisms. A way of viewing world – Agents, responsibility, messages, methods, History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, method binding, inheritance, overriding and exceptions, parameter passing, recursion, nested and inner classes, exploring string class.

UNIT-II

INHERITANCE, PACKAGES AND INTERFACES

Inheritance, Packages and Interfaces – Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring java.io.

UNIT-III

EXCEPTION HANDLING AND MULTITHREADING

Exception handling and Multithreading-- Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. String handling, Exploringjava.util. Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads. Enumerations, autoboxing, annotations, generics.

UNIT-IV

EVENT HANDLING and APPLETS

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, checkbox groups, choices, lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

REFERENCE BOOKS

1. Object Oriented Programming through Java, Dr. P. Santosh Kumar Patra, Dr. R. Santhosh Kumar, Ms. Afreen Begum, Surneni International Book Publishers
2. Java the complete reference, 7th edition, Herbert schildt, TMH.
3. Understanding OOP with Java, updated edition, T. Budd, Pearson education.
4. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley& sons.
5. An Introduction to OOP, third edition, T. Budd, Pearson education.
6. Introduction to Java programming, Y. Daniel Liang, Pearson education.
7. An introduction to Java programming and object-oriented application development, R.A. Johnson-Thomson.
8. Core Java 2, Vol 1, Fundamentals, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education.
9. Core Java 2, Vol 2, Advanced Features, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education
10. Object Oriented Programming with Java, R.Buyya, S.T.Selvi, X.Chu, TMH.
11. Java and Object Orientation, an introduction, John Hunt, second edition, Springer. Maurach‟s Beginning Java2 JDK 5, SPD.

ST 105: DISCRETE MATHEMATICS

UNIT-I
MATHEMATICAL LOGIC

Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT-II
SET THEORY

Set Theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT-III
ALGEBRAIC STRUCTURES

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT-III
ELEMENTARY COMBINATORICS

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

REFERENCE BOOKS

1. Discrete Mathematics, Dr. P. Santosh Kumar Patra, Dr. D. Ranadheer Reddy, Mr. K. Upender Reddy, Spectrum University Press, Hyderabad
2. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
3. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2nd ed.
4. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, Pearson education, 5th edition.
5. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill publishing co.

Course Outcomes:

1. Use standard notations of propositional logic.
2. Understand the truth tables for expressions involving negation, conjunction, and disjunction
3. Determine if a logical argument is valid or invalid.
4. Find concepts and notations from discrete mathematics are useful in studying Automata theory, Number theory and mathematical cryptography.

M.Sc. STATISTICS

Semester-II

ST- 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 Truncateddistribution.

Unit-IV

Statistical decision theory – decision problems and two person games, problems ofinference viewed as decision problems, non-randomized and randomized decision rules, Lossand Risk functions, admissibility, complete and essentially complete class, complete classtheorem.Bayes principle, determination of Bayes rule Minimax principle, determination ofminimax rule, minimax theorem. Minimax estimates of parameters of Binomial, Poisson andNormal 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, MercelDackerInc
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, ChalesGriffin 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.

ST-202 :Operation Research

Course Objectives:

1) Operations research helps in solving problems in different environments that needs decision.
2) This module aims to introduce students to use quantitative methods and techniques for effective decisions-making: model formulation and applications that are used in solving business decision problems.
3) Deterministic inventory models, EOQ model, no step model, setup model.
4) Queuing system, Elements of a queuing model, pure birth, death model.
5) Generalized poisson queuing model specialized poisson queues, single server model, multi-server model.
6) Network models, enumeration of cuts, maximal flow algorithm, linear programming formulation of maximal flow mode, CPM computations.

UNIT- 1

Linear Programming problem Mathematical formulation, assumptions in linear programming, graphical method of solution, simplex method, Big-M method and Two phase method, Dual simplex method.

Unit-2

Integer Programming Introduction, Gomory's cutting plane method, Fractional cut method-Mixed integer and branch and bound techniques.

Transportation Problem-General transportation problem, Finding an initial basic feasible solution, Loops in transportation tables, Degeneracy, Optimality method-MODI method.

Assignment Problem- Hungarian Method, Traveling salesman problem.

Unit-3

Game Theory Introduction, two-person zero-sum games, some basic terms, the maxmini-minimax principle, games without saddle points-Mixed Strategies, graphic solution of 2 * n and m*2 games, dominance property.

Simulation Introduction, Definition of Monte-Carlo Simulation.

Queuing Theory Introduction, Queuing system, Elements of Queuing system, Characteristics of Queuing system, Classification of Queuing Models, Poisson Queuing systems-Model I (M/M/1): (:FIFO)-Characteristics of Model I and waiting time characteristics. Characteristics of (M/M/1):(N/FIFO),(M/M/C):(/FIFIO), (M/M/C):(N/FIFO)-all without derivation

Unit-4

Dynamic Programming Introduction, The Recursive equation approach, Algorithm, Solution of a L.P.P by Dynamic Programming.

Sequencing Models-Processing n jobs through 2 machines, n jobs through 3 machines, two jobs through m machines.

Networking AnalysisCPM & PERT – Network minimization, shortest route problem, maximal-flow problem, Project scheduling, critical path calculations, PERT calculation.

Suggested Readings:

- Operation Research by KantiSwarup, P.KGuptha , Man Mohan 11th edition Sultan Chand & Sons Publication.
- Operation Research , Jaico Publishing House
- Operation Research-An introduction by Hamdy A Taha. Prentice Hall.
- Introduction To Management Science, Anderson, Thomson Learning, 11Edn.
- Operation Research Applications and Algorithms, Winston, Thomson Learning, 4Edn.
- Introduction to Operation Research by Hiller/Lieberman. McGraw Hill.

Course Outcomes:

1) Formulate some real life problems into Linear Programming Problem.
2) Solve linear programming problem by using algebraic graphical method.
3) Use the simplex method to find an optimal vector for the standard linear programming problem and the corresponding dual problem.
4) Prove the optimality condition for feasible vectors for Linear Programming Problem and Dual Linear Programming Problem.
5) Use operations research to solve transportation problems during the allocation of trucks to the formulate operation research models to solve real life problem.
6) Understand Queuing theory basic concepts and solve queuing theory problems.
7) Deterministic inventory models, static economic, classic EOQ models.

ST - 203: Python

Unit-I: Introduction to Python

Introduction to Python: Installing Python. How a Program Works, Using Python, ProgramDevelopment Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elseif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while-loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

Unit-II: Data Types and Expressions

Data types and Expressions: Strings, Assignment and Comments, Numeric Data Types andCharacter Sets, Expressions, Functions and Modules. Lists, Tuples, Dictionaries: Lists: listoperations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

Unit-III: Design with Classes, Files and Exceptions

Design with Classes: Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes. Files: Text files, reading and writing files; command line arguments, Illustrative programs: word count, copy file. Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, Creating Exception.

Unit-IV: Expressions and Multithreading, Graphics and GUI Interfaces

Regular Expressions: Introduction, Special Symbols and Characters, Res and Python Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules.

Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing. Graphical User Interfaces: Coding simple GU Ibased programs, other useful GUI resources. GUI Programming: Graphical User Interfaces, Using the tkinter Module**,** Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Reference Books

1.Python Programming, Theory, Concepts, and Applications Dr. P. Santosh Kumar Patra, Ms. Md. ZahedaParveen, Dr. N. Satheesh, Dr. T. Poongothai, StudentsHelpline Publishing House Pvt. Ltd.

2. A Practical Introduction to Python Programming, Brian Heinold.

3. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, CengageLearning.

5. Think Python First Edition, by Allen B. Downey, Orielly publishing

6. Introduction to Computation and Programming Using Python. John V. Guttag,The MIT Press.

7. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing.

8. Paul Gries, Practical Programming: An Introduction to Computer Science usingPython, The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013).

9. Charles Dierach, Introduction to Computer Science using Python.

ST- 204: Statistical Process and 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. Processmonitoring and control, process capability, modified control chart. Capability indices Cp, Cpk,and Cpm. Concept of Six sigma and its relationship with process capability.

Unit-II: The OC and ARL of Shewart's control charts. Control by gauging, MovingAverage and Exponentially Weighted Moving Average charts. CUSUM charts using V-maskand decision interval methods. Multivariate control charts – Control Ellipsoid, Hotelling's T2chart.

Unit-III: Acceptance sampling plans for attribute inspection – Type-A and Type-B OCcurves. Single, double and sequential sampling plans and their properties. Sampling planswith rectifying inspection-concept of AOQ, AOQL. Design of Single sampling plan withgiven ATI.Plans for inspection by variables with one-sided and two-sided specifications.

Unit-IV: Sampling plans for continuous inspection-construction of Dodge CSP-1, CSP-2 andMulti level plans and their properties.Chain sampling and its applications.Design of Skip lotsampling plan and its ASN. Sampling plans with inspection error- derivation of AOQ andATI in presence of errors.

References

1. Montgomery D.C (2009), Introduction to Statistical Quality Control, 6/e, John Wileyand Sons, New York.

2. Edward G. Schilling, Dean V. Neubauer, (2009), Acceptance sampling in qualitycontrol 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, McGraw 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

ST - 205 : Analyses

Analyses

This course covers Riemann-Stieltjes Integral, Sequences and Series of Functions, Functions of Several Variables, Improper Integrals, Fourier series, Maxima and Minima.

Course Objectives:

1) Acquired knowledge on Riemann-Stieltjes Integration and Differentiation.
2) To apply Integration of Vector Valued Functions, Rectifiable Curves.
3) Discussion of main problem Sequences and Series of Function.
4) Uniform Convergence, Continuity Integration and Differentiation.

UNIT –I:

The Riemann –StieltijesIntegral : Definition and Existence of the integral properties of the integral, integration and Differentiation, Integration of vector valued function, Rectifiable curves.

UNIT – II:

Sequence and series of functions : Discussions of main problem, uniform convergence, uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation, Equicontinuous families of functions, The stone –Weistrass theorem .

Scope and standard as in Chapters 6, sections 7.1 to 7.26 of chapter 7 of Walter Rudin" Principles of Mathematical Analysis" 3rd edition 1976, Nc. Graw hill International student edition.

UNIT – III:

Improper Integrals: Introduction, Integration of unbounded functions with finite limit of Integration, comparison tests for convergence at a $\propto$, infinite Range of Integration.

Fourier series: Trigonometrically series, some preliminary theorems, the Main theorem intervals other than -$[-\Pi, \Pi]$

UNIT-IV:

Functions of Several Variables : Explicit and Implicit functions, Continuity, Partial derivations, differentiability, partial derivatives of higher order, differentials of higher order, function of functions, change of variables, Taylor's theorem, Extreme values, Maxima and Minima, functions of several variables.

Scope and standard as in chapters 11, 12 and 15 of **Mathematical Anlaysis by " S.C. Malik 1994" Wiley Eastern limited**

Reference:

(1) Mathematical Analysis- A modern Approach to Advanced Calculus Narosa Book Distributors Pvt LTD- New Delhi

(2) Real Analysis - Golden Math Series By N.P. Bali.

(3) A course of Mathematical Analysis by Shanti Narayan -.K. Mittal , S-Chand & Company LTD-New Delhi

Course Outcomes:

1. Understand the concepts of Riemann Integration and Differentiation.
2. To learn the different types of Sequences and Series of Functions, Equicontinuous Families of Functions.
3. Understand Uniform Convergence and continuity.
4. Apply the Stone-Weierstrass theorem.
5. Analyze the concept of functions of several variables.
6. Study the applications of Integration and Differential forms.