ST. MARY'S COLLEGE (AUTONOMOUS)

Re-accredited with A+ Grade by NAAC

Thoothukudi – 628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)

Syllabus

M.Sc. Mathematics

School of Computing Sciences

Outcome Based Curriculum

(w.e.f. 2024)

Preamble

Mathematics is the most beautiful and powerful tool, there's math all over the Universe and factors into every aspect of life. Many professions, such as engineering, medicine, physics, pharmacy, computer science and actuarial science, require math proficiency. Virtually all fields benefit from the analytical and problem-solving skills that students learn in mathematics. There is a remarkable correlation between mathematics that is beautiful, and mathematics that is important. Indeed, discovering surprising connections is one of the greatest joys of mathematics. The program has been designed to provide the opportunity to learn and refresh mathematical skills and ability.

Vision:

Contribute to the development of students as mathematical thinkers, enabling them to become lifelong learners, to continue to grow in the chosen professions, and to function as productive citizens.

Mission:

To provide an environment where students can learn and become competent users of mathematics and mathematical applications.

Program Outcome

PO No.	**After completion of the Postgraduate programme the students of St. Mary's College will be able to**
PO 1	acquire expertise knowledge in their respective disciplines and become professionals.
PO 2	develop critical/logical thinking skills, managerial skills and become locally, nationally & globally competent and be a lifelong learner
PO 3	pursue research / higher learning programme & apply their experiment and research skills to analyze and solve complex problems.
PO 4	compete in the job market by applying the knowledge acquired in Arts, Science, Economics, Commerce and Management studies
PO 5	be an empowered and economically independent woman with efficient leadership qualities and develop the themselves as a holistic person

Course Structure (w.e.f. June 2024)
Semester – I

Course	Course Code	Course Title	Contact Hours / Week	Credits	Max Marks		
					CIA	ESE	Total
Core I	24PMAC11	Algebra I	6	4	40	60	100
Core II	24PMAC12	Real Analysis	5	4	40	60	100
Core III	24PMAC13	Ordinary Differential Equations	5	4	40	60	100
Core IV	24PMAC14	Mechanics	5	4	40	60	100
Discipline Specific Elective I	24PMAE11 24PMAE12	**Stochastic Process** / Calculus of Variations and Integral Equations	5	3	40	60	100
Skill Enhancement Course I	24PMASE1	Mathematical Python	4	3	40	60	100
MOOC (Compulsory)				+2			
			30	**22+2**			

Semester – II

Course	Course Code	Course Title	Contact Hours / Week	Credits	Max Marks		
					CIA	ESE	Total
Core V	24PMAC21	Algebra II	6	4	40	60	100
Core VI	24PMAC22	Mathematical Analysis	5	4	40	60	100
Core VII	24PMAC23	Mathematical Statistics	5	4	40	60	100
Core VIII	24PMAC24	Research Methodology	5	4	40	60	100
Discipline Specific Elective II	24PMAE21 24PMAE22	**Fluid Mechanics** / Wavelet Analysis	5	3	40	60	100
Skill Enhancement Course II	24PMASE2	Statistics Using RProgramming	4	3	40	60	100
			30	**22**			

Note: MOOC can be completed within II Semester.

Semester I			
Core I	**Algebra I**		
Course Code: 24PMAC11	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Objectives

- To provide an introduction of dual spaces, modules, finite abelian groups and to develop working knowledge of Euclidean rings.
- To enrich the students with the knowledge of Abstract Algebra.

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	recall the orbit for a set and make use of another counting principle technique to find algebraic descriptions for the size of each equivalence class.	K1
CO-2	explain Sylow's theorem for all finite groups.	K2
CO-3	compute the abelian groups generated by a finite set of elements and to find the root of unity for each element of a group.	K3
CO-4	analyze and demonstrate the examples of Ideals and Quotient Rings.	K4
CO-5	evaluate the properties implied by the definition of Euclidean Rings and to illustrate and apply the concepts of Polynomial Rings.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**
CO-3	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO-4	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO-5	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**
Ave.	**3**	**2.8**	**2.2**	**2**	**2**	**3**	**2.4**	**2.4**	**1.8**	**1.8**

Semester I			
Core I	**Algebra I**		
Course Code: 24PMAC11	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Unit I

Another Counting Principle - First part of Sylow's Theorem(First proof only)- Second part of Sylow's Theorem- Third part of Sylow'sTheorem

Unit II **Chapter 2: Sections 2.11 , 2.12 (Omit Lemma 2.12.5)**

Direct Products - Finite Abelian Groups.

Chapter 2: Sections 2.13, 2.14

Unit III

Ring Theory - Homomorphisms- Ideals and Quotient Rings – More Ideals and Quotient Rings -The Fields of Quotients of an Integral Domain.

Chapter 3: Sections 3.3, 3.4, 3.5, 3.6

Unit IV

Euclidean Rings - A Particular Euclidean Ring - Polynomial Rings -Polynomials over the Rational Field.

Chapter 3: Sections 3.7, 3.8, 3.9, 3.10

Unit V

Dual Spaces - Inner product Spaces - Orthogonal Complement - Norm - Gram Schmidth Process - Schwartz Inequality - Modules - R-Module - Unital R-Module - Module Homomorphisms - Finitely Generated Module.

Chapter 4: Sections 4.3, 4.4, 4.5

Text Book

1. I. N. Herstein. *Topics in Algebra*. New Delhi: Wiley Eastern Ltd. Second Edition, 2013.

Books for Reference

1. Gavvett Birkhoff and Thomas C. Bartee. *Modern Applied Algebra.* Delhi: CSS Publishers and Distributors, 1987.
2. P.B Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic abstract algebra, Cambridge University Press, 1987.
3. M.Artin, *Algebra,* Prentice Hall of India, 1991.

Semester I			
Core II	**Real Analysis**		
Course Code: 24PMAC12	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives

- To acquire thorough knowledge about real functions, limit functions and their properties.
- Have the knowledge of basic properties of the field of real numbers

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Understand the fundamental concepts of metric spaces and their importance in mathematical analysis.	K1
CO-2	Discuss the basic properties of sequences and their convergence, including the definition of convergent sequences and the limit of a sequence.	K2
CO-3	Apply the concepts learned in the course to solve problems in calculus, analysis, and other areas of mathematics, including determining convergence, finding sums of series, and evaluating functions represented by power series.	K3
CO-4	Investigate the relationship between continuity and connectedness, including the characterization of continuous images of connected sets and the preservation of connectedness under continuous mappings.	K4
CO-5	Evaluate and apply the mean value theorems, including the Intermediate Value Theorem for derivatives and analyze the behavior of differentiable functions.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**
CO-3	**3**	3	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**
CO-4	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-5	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**
Ave.	**3**	**2.4**	**2.6**	**2.4**	**2**	**3**	**2.6**	**2.4**	**2.6**	**2**

Semester I			
Core II	**Real Analysis**		
Course Code: 24PMAC12	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Unit I

Metric Spaces- Compact sets- Perfect sets- Connected sets.

Chapter 2

Unit II

Convergent Sequences - Subsequences - Cauchy Sequences - Upper and Lower Limits - Some Special Sequences- Series of nonnegative terms - The Number e.

Chapter 3

Unit III

The Root and Ratio Tests - Power Series - Summation by parts - Absolute Convergence - Addition and Multiplication of series – Rearrangements.

Chapter 3

Unit IV

Limits of functions - Continuous functions - Continuity and Compactness - Continuity and Connectedness - Discontinuities - Monotone functions - Infinite limits and limits at infinity

Chapter 4

Unit V

The Derivative of a real function - Mean value Theorems - The continuity of derivatives - L'Hospital's Rule - Derivatives of Higher order - Taylor's Theorem.

Chapter 5

Text Book

1. Walter Rudin. *Principles of Mathematical Analysis*. McGraw-Hill International Editions. Third Edition, 1953.

Books for Reference

1. Apostol. *Mathematical Analysis*. London. Addition Wesley Publishing Company, 1971.
2. Goldberg. *Methods of Real Analysis*. Oxford & IBH Publishing Company, 1970.
3. Bartle, R.G. *Real Analysis*, John Wiley and Sons Inc., 1976.

Semester I			
Core III	**Ordinary Differential Equations**		
Course Code: 24PMAC13	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives

- To develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points
- To study existence and uniqueness of the solutions of first order differential equations

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Define the qualitative behavior of solutions of systems of differential equations.	K1
CO-2	Identify the physical phenomena modeled by differential equations and dynamical systems.	K2
CO-3	Compute solutions using appropriate methods and give examples.	K3
CO-4	Simplify the ordinary differential equations using variation of parameters, undetermined coefficients and by numerical tequnique.	K4
CO-5	Estimate and use various theoretical ideas and results that underlie the mathematics in this course.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**3**	2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO-5	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**1**	**3**	**2**
Ave.	**2.6**	**2.4**	**2.2**	**2.2**	**2**	**2.8**	**2.4**	**2**	**2.4**	**2**

Semester I			
Core III	**Ordinary Differential Equations**		
Course Code: 24PMAC13	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Unit I

Linear equations with constant coefficients: Introduction – The Second order homogeneous equation –Initial value problems for second order equations - Linear dependence and independence - A formula for the Wronskian – The non-homogeneous equation of order two.

Chapter 2: Sections 1 to 6

Unit II

Linear equations with constant coefficients: The homogeneous equation of order n - Initial value problems for n^{th} order equations - Equations with real constants - The non- homogeneous equation of order n - A special method for solving the non-homogeneous equation.

Chapter 2: Sections 7 to 11

Unit III

Linear equation with variable coefficients: Introduction - Initial value problems for the homogeneous equation - Solutions of the homogeneous equation - The Wronskian and linear independence - Reduction of the order of a homogeneous equation - The non - homogeneous equation – The Legendre equation.

Chapter: 3 Sections 1 to 6 and 8

Unit IV

Linear equation with regular singular points: Introduction - The Euler equation - Second order equations with regular singular points – an example - Second order equations with regular singular points - the general case - The exceptional cases - Bessel Function.

Chapter 4: Sections 1 to 4 and 6 to 8

Unit V

Existence and uniqueness of solutions to first order equations: Introduction - Equation with variable separated - Exact equations - The Method of successive approximations - The Lipschitz condition

Chapter 5: Sections 1 to 5

Text Book

1. E.A.Coddington, *An Introduction To Ordinary Differential Equations* (3^{rd} Printing) Prentice-Hall ofIndia Ltd., New Delhi, 1987.

Books for Reference

1. Williams E. Boyce and Richard C. DI Prima, *Elementary differential equations and boundaryvalue problems*, John Wiley and sons, New York, 1967.
2. George F Simmons, *Differential equations with applications and historical notes,* Tata McGrawHill, New Delhi, 1974.
3. N.N. Lebedev, *Special functions and their applications*, Prentice Hall of India, New Delhi, 1965.

Semester I			
Core IV	**Mechanics**		
Course Code:24PMAC14	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives

- To represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulation.
- To develop math skills as applied to physics.

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the classical dynamics in a systematic way	K1
CO-2	describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle.	K2
CO-3	demonstrate the knowledge of core principles in Mechanics.	K3
CO-4	apply the variation principle for real physical situations.	K4
CO-5	explore different applications of these concepts in the mechanical fields.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**3**	2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO-5	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**1**	**3**	**2**
Ave.	**2.6**	**2.4**	**2.2**	**2.2**	**2**	**2.8**	**2.4**	**2**	**2.4**	**2**

Semester I			
Core IV	**Mechanics**		
Course Code:24PMAC14	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Unit I

Some Definitions-Lagrange's Equations for a Holonomic System- Lagrange's Equations of Motion for Conservative, Non –Holonomicsystem - Physical Significance of λ_l.

Chapter 1: Sections 1.1, 1.2, 1.3, 1.4

Unit II

Variational Principle - Calculus of Variations- Hamilton's Principle - Derivation of Hamilton's Principle from Lagrange's Equations- Derivation of Lagrange's Equations from Hamilton's Principle - Extension of Hamilton's Principle - Cyclic or Ignorable Coordinates-Conservation Theorems

Chapter 2: Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8

Unit III

Equations of Motion of a Rigid Body- Generalized Coordinates of a Rigid body- Eulerian Angles - Components of Angular Velocity along the Body Set of Axes- Rate of Change of a Vector-Coriolis force-Euler's Equations of motion for a rigid body-Motion of a Heavy Symmetrical Top.

Chapter 3: Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8

Unit IV

Derivations of Hamilton's Equations of Motion - Routh's procedure - Equations of motion - Derivation of Hamilton's equations from Hamilton's principle - Principle of least action.

Chapter 4: Sections 4.1, 4.2, 4.3, 4.4

Unit V

Canonical coordinates and canonical transformations - Hamilton's Equations of Motion in Poisson's Bracket - Infinitesimal contact Transformation - Relation between Infintesimal contact Transformation and Poisson's Bracket - Hamilton - Jacobi theory.

Chapter 5: Sections 5.1, 5.2, 5.3, 5.4, 5.5

Text Book

1. C.R.Mondal. *Classical Mechanics*. Prentice Hall of India, 2007.

Books for Reference

1. H. Goldstein, *Classical Mechanics*, (2nd Edition) 2000, Narosa Publishing House, New Delhi

2. N.C. Rane and P.S.C Joag, *Classical Mechanics*, Tata McGraw Hill, 1991.

3.D. Greenwood, *Classical Dyanamics*, Prentice Hall of India, New Delhi, 1983

Semester – I			
Discipline Specific Elective I	**Stochastic Processes**		
Course Code: 24PMAE11	**Hrs/week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Course Objectives

- To acquire knowledge about stochastic process relying on the probability theory and mathematical analysis.
- To develop comprehensive knowledge of Probability Distribution, Transition Probabilities, Markov Chains, Birth – Death Process.

Course Outcome:

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	list the random walk associated with real life situation to solve.	K1
CO-2	understand the notions of stochastic process.	K2
CO-3	apply markov chains to practical problems	K3
CO-4	analyze the transition probabilities and its classifications	K4
CO-5	evaluate and illustrate the different stochastic models.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	2	2	3	2	3	2	2
CO-2	2	2	3	2	2	2	3	2	3	2
CO-3	2	2	2	3	2	3	2	2	2	2
CO-4	3	2	2	2	2	3	3	2	2	2
CO-5	3	3	3	2	2	3	2	2	3	2
Ave.	2.6	2.4	2.4	2.2	2	2.8	2.4	2.2	2.4	2

Semester – I			
Discipline Specific Elective I	**Stochastic Processes**		
Course Code: 24PMAE11	**Hrs/week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Unit I

Generating functions – Laplace Transforms – Laplace Transforms of a Probability Distribution or of a Random Variable – Difference Equations

Chapter 1: Sections: 1.1 - 1.4

Unit II

Difference Equations in Probability Theory – Differential - Difference Equations – Notion of Stochastic Processes – Specification of Stochastic Processes – Stationary Processess

Chapter 1: Sections: 1.5, 1.6 and Chapter 2: Sections: 2.1 - 2.3

Unit III

Markov Chains – Higher Transition Probabilities – Classification of States and Chains – Determination of Higher Transition Probabilities – Stability of a Markov System: Limiting Behaviour

Chapter 3: Sections: 3.1 - 3.5

Unit IV

Birth and Death Process – Markov Processes with Discrete State Space – Erlang Process

Chapter 4: Sections: 4.4 - 4.6

Unit V

Brownian Motion – Wiener Process – Differential Equations for a Wiener Process – Kolmogorov Equations

Chapter 5: Sections: 5.1 – 5.4

Text Book:

1. J.Medhi. *Stochastic Process*. Wiley Eastern Limited, 1982.

Books for Reference:

1. SrinivasanMehata. *Stochastic Process*. New Delhi: Tata McGraw-Hill PublishingCompany Limited, 1976.
2. Tapas kumar Chandra and Sreela Gangopadhyay. *Introduction to Stochastic Process*, Narosa Publishing House, 2018.
3. Peter W. Jones and Peter Smith, *Stochastic Processes An Introduction*, Third Edition, CRC Press, Taylor and Francis Group, 2018.

Semester I			
Discipline Specific Elective I	**Calculus of Variations and Integral Equations**		
Course Code: 24PMAE12	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Course Objectives

- To impart analytical ability in solving variational problems and integral equations also to formulate the laws of mechanics and basic physics.
- To provide the foundation of Calculus of variation and give examples on some applications within Physics and Engineering Sciences.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the properties of geometrical problems	K1
CO-2	apply ariational problems and isoperimetric problems.	K2
CO-3	evaluate to the decomposition method.	K3
CO-4	compare different types of integral equations.	K4
CO-5	solve variational problems with constraints both algebraic and isoperimetric.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**
CO-3	**3**	3	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO-4	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO-5	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**
Ave.	**3**	**2.8**	**2.8**	**2**	**2**	**5**	**2.8**	**2.6**	**2.4**	**2**

Semester I			
Discipline Specific Elective I	**Calculus of Variations and Integral Equations**		
Course Code:24PMAE12	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Unit I

Calculus of Variations and Applications: Maxima and Minima - The Simplest case - Illustrative examples - Natural boundary conditions and transition conditions - The variational Notation - The more general case.

(Chapter 2: Sections: 2.1 - 2.6)

Unit II

Constraints and Lagrange multipliers - Variable end points – Sturm - Liouville problems - Hamilton's principle - Lagrange's equations.

(Chapter 2: Sections: 2.7 - 2.11)

Unit III

Integral Equations: Introduction - Relations between differential and integral equations -The Green's function - Alternative definition of the Green's function.

(Chapter 3: Sections: 3.1 - 3.4)

Unit IV

Linear equations in cause and effect - The influence function - Fredholm equations with separable kernels - Illustrative example.

(Chapter 3: Sections: 3.5 - 3.7)

Unit V

Hilbert-Schmidt theory- Iterative methods for solving equations of the second kind - Fredholm theory.

(Chapter 3: Sections: 3.8, 3.9, 3.11)

Text Book

Francis B. Hildebrand. *Methods of Applied Mathematics*. Prentice-Hall of India private limited. second edition, 1968.

Books for Reference

1. L. Elsgolts. *Differential Equations and the Calculus of Variations*. University Press of the Pacific, 2003.
2. Mark Kot. *A First Course in the Calculus of Variations*. American Mathematical Society Providence Rhode Island, 2014.
3. Lev Elsgolc, *Calculus of Variation*, Dover Books of Mathematics ,2007

Semester I			
Skill Enhancement Course I	**Mathematical Python**		
Course Code: 24PMASE1	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Course Objectives

- To demonstrate problem solving techniques, algorithm problem solving, understanding of basic python and python functions in mathematical problem solving
- To represent compound data using python lists, tuples and dictionaries

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the basic concepts of python programming	K1
CO-2	define and demonstrate the use of functions and looping using python.	K2
CO-3	solve mathematical model for real world problems	K3
CO-4	analyze and implement a program to solve a real world problems	K4
CO-5	design algorithms for mathematical models, analyze the efficiency and correctness of algorithms	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**3**	2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO-5	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**1**	**3**	**2**
Ave.	**2.6**	**2.4**	**2.2**	**2.2**	**2**	**2.8**	**2.4**	**2**	**2.4**	**2**

Semester I			
Skill Enhancement Course I	**Mathematical Python**		
Course Code: 24PMASE1	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Unit I

Python : Introduction – Numbers – Strings- Variables – Lists – Tuples – Dictionaries – Sets – Comparisons. Code Structure: if, else if and else – repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Expectation.

Unit II

Introduction to NumPy: Understanding data types in Python – The Basics of NumPy Arrays – Computation on NumPy Arrays: Universal Functions – Aggregation: Min, Max and Everything in Between – Computation on Arrays: Broadcasting – Comparisons, Masks and Boolean Logic – Fancy Indexing – Sorting Arrays – Structured Data: NumPys : Structured Arrays

Unit III

Data Manipulation with Pandas: Installing and Using Pandas – Data Indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Set – Aggregation and Grouping – Pivot Tables – Vectorized string Operations

Unit IV

Problem Solving Techniques – Algorithm, Flow Chart, Pseudocode, Programming. Algorithms: Properties, Quality (Time, Space), Building Blocks of Algorithms – Statements, State, Control flow, Functions, Notations(pseudocode, flow chart, programming language).

Unit V

Algorithmic Problem Solving, Simple Strategies for Developing Algorithms (Iteration, Recursion), Pseudocode for some Mathematical Problems – Greatest of two numbers, Print n natural numbers, Greatest Common Divisor, Fibonacci Sequence upto n terms. Practical Applications of Algorithms

Text Book

1. BillLubanovic, *Introducing Python*, O'Reilly, First Edition – Second Release, 2014
2. Jake VanderPlas, *Python Data Science Handbook Essential Tools for Working with Data*, O'Reilly Media, Inc., First Edition, 2016

Books for Reference

1. David M. Beazley, *Python Essential Reference*, Developer's Library, Fourth Edition 2009.
2. Wes McKinney, *Python for Data Analysis: Data Wrangling with Pandas, NumPy and Ipython*, O'Reilly, Second Edition 2018
3. Allen B. Dowley, *Think Python: How to think like a Computer Scientist*, Second Edition

Semester II			
Core V	**Algebra II**		
Course Code: 24PMAC21	**Hrs/Week: 6**	**Hrs/Semester: 90**	**Credits: 4**

Course Objectives

- To reveal the ability to use algebraic properties to describe interpret and analyze the real world data.
- To introduce the concepts and to develop working knowledge on linear transformations, finite fields and integral quaternions.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Define Jordan, canonical form, Jordan blocks, define rational canonical form, define companion matrix of polynomial.	K1
CO-2	Explain the concepts of trace, define transpose of a matrix, explain the properties of trace and transpose, to find trace, to find transpose of matrix and define Hermitian, unitary, normal transformations and to verify whether the transformation in Hermitian, unitary and normal.	K2
CO-3	Compute matrices associated with linear transformations andvice versa.	K3
CO-4	Bring out insight into Abstract Algebra with focus on axiomatic theories.	K4
CO-5	Evaluate the fundamental concepts of algebra and their role in modern mathematics and applied contexts.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**
CO-3	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**2**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**
CO-5	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**
Ave.	**3**	**2.2**	**2**	**2**	**2**	**3**	**2.2**	**2**	**2.4**	**2**

Semester II			
Core V	**Algebra II**		
Course Code: 24PMAC21	**Hrs/Week: 6**	**Hrs/Semester: 90**	**Credits: 4**

Unit I

Linear Transformations: Canonical forms - Triangular form - Nilpotent transformations.

Chapter 6: Sections 6.4, 6.5

Unit II

Jordan form - Rational canonical form

Chapter 6: Sections 6.6, 6.7

Unit III

Trace and transpose - Hermitian, unitary, normal transformations, real quadratic form.

Chapter 6: Sections 6.8, 6.10 and 6.11

Unit IV

Finite fields - Wedderburn's theorem on finite division rings.

Chapter 7: Sections 7.1 and 7.2 (Theorem 7.2.1 only)

Unit V

A theorem of Frobenius - Integral Quaternions and the Four - Square theorem.

Chapter 7: Sections 7.3 and 7.4

Text Book

1. I.N.Herstein. *Topics in Algebra*. New Delhi: Wiley Eastern Ltd. Second Edition, 2013.

Books for Reference

1. GavvettBirkhoff and Thomas C. Bartee. *Modern Applied Algebra*. Delhi: CSS Publishers and Distributors, 1987.
2. P.B Bhattacharya, S.K. Jain and S.R. Nagpaul. *Basic abstract algebra*. Cambridge University Press, 1987.
3. I.S.Luther and I.B.S.Passi, *Algebra*, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House New Delhi, 1999

Semester II			
Core VI	**Mathematical Analysis**		
Course Code: 24PMAC22	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives

- To give a systematic study of Riemann Stieltjes integral and calculus on R^n and a brief study of convergence of sequence and series, power series and polynomial.
- To expose the concepts of convergence, uniform convergence, power series and the application of function of several variables.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Define the concept of Riemann-Stieltjes integral and its properties	K1
CO-2	Describe functions of bounded variation and Rectifiable Curves	K2
CO-3	Apply the concepts learned in the course to solve problems involving uniform convergence, integration, and differentiation, including determining conditions for the interchange of limits and operations.	K3
CO-4	Illustrate the relationships between special functions, including their representations as power series, exponential, logarithmic, and trigonometric functions, and understand their connections in real analysis and other branches of mathematics.	K4
CO-5	Evaluate the concepts of Fourier Series and Beta, Gammafunctions.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	2	3	2	2	2	2
CO-2	3	2	3	2	2	3	2	2	3	2
CO-3	3	3	2	2	2	3	3	2	3	2
CO-4	3	2	3	3	2	3	3	2	3	2
CO-5	3	2	2	2	2	3	2	2	2	2
Ave.	3	2.2	2.6	2.2	2	3	2.4	2	2.6	2

Semester II			
Core VI	**Mathematical Analysis**		
Course Code: 24PMAC22	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Unit I

Riemann - stieltjes integral: Definition and Existence of Riemann - Stieltjes Integral - Properties of the integral

Chapter 6

Unit II

Integration and Differentiation - Rectifiable curves. Sequences and series of functions: Discussion of Main problem - Uniform Convergence - Uniform Convergence and Continuity

Chapter 6 & 7

Unit III

Uniform Convergence and Integration - Uniform Convergence and Differentiation - Equicontinuous families of Functions - Stone Weierstrass Theorem.

Chapter 7

Unit IV

Some special functions: Power series - The Exponential and Logarithmic Functions - The Trigonometric Functions - The Algebraic Completeness of the Complex field

Chapter 8

Unit V

Fourier series - The Gamma function.

Chapter 8

Text Book

1. Walter Rudin. *Principles of Mathematical Analysis*. McGraw Hill International Editions. Third Edition, 1953.

Books for Reference

1. Apostol. *Mathematical Analysis.* London: Addition Wesley Publishing Company, 1971.
2. Goldberg. *Methods of Real Analysis*. Oxford & IBH Publishing Company, 1970.
3. Malik,S.C. and Savita Arora. *Mathematical Analysis*, Wiley Eastern Limited. New Delhi, 1991.

Semester II			
Core VII	**Mathematical Statistics**		
Course Code: 24PMAC23	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Objectives

- To enable the use of statistical techniques whenever relevant.
- To have a proper understanding of statistical applications in real life.

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the concepts of distributions and apply them.	K1
CO-2	compare the distribution with one another.	K2
CO-3	explain moment generating function and derive them.	K3
CO-4	learn the convergence in distribution of sequence of random variable	K4
CO-5	illustrate the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO-2	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO-5	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**
Ave.	**2.6**	**2.4**	**2.2**	**2**	**2**	**2.8**	**2.4**	**2.4**	**2.2**	**2.6**

Semester II			
Core VII	**Mathematical Statistics**		
Course Code: 24PMAC23	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Unit I

Distribution of Two Random Variables – Conditional Distributions and Expectations- The correlation coefficient-Independent Random Variables-Extension to Several Random Variables.

(Chapter 2: Sections 2.1, 2.2, 2.3, 2.4, 2.5)

Unit II

Some special Distributions: The Binomial and Related Distributions – The Poisson Distribution - The Gamma and Chi-square Distributions – The Normal Distribution – The Bivariate Normal Distribution.

(Chapter 3: Sections 3.1, 3.2, 3.3, 3.4, 3.5)

Unit III

Distributions of functions of Random variables: Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type – The Beta, t, and F Distributions.

(Chapter 4: Sections 4.1, 4.2, 4.3, 4.4)

Unit IV

Extensions of the Change of variable technique – Distributions of Order statistics – The Moment generating function technique – The Distributions of $\bar{X}$ and nS^2/σ^2 – Expectations of functions of random variables.

(Chapter 4: Sections 4.5, 4.6, 4.7, 4.8, 4.9)

Unit V

Limiting Distributions: Convergence in Distribution – Convergence in Probability – Limiting Moment Generating Function – The central limit theorem – Some theorems on Limiting Distributions.

(Chapter 5: Sections 5.1, 5.2, 5.3, 5.4, 5.5)

Text Book

1. Robert V. Hogg and AllenT.Craig. *Introduction to Mathematical Statistics*. Pearson Education Asia. Fifth edition, 2004.

Books for Reference

1. J.N.kapur, H.C. Saxena. *Mathematical Statistics*. S.Chand& Co, 2013.
2. Keith Knight. *Mathematical Statistics*. New York. Chapman & Hall/CRC, 2000.
3. S. C. Gupta, V.K.Kapoor, *Fundamentals of MathematicalStatistics*, Tenth Revised Edition, Sultan Chand and Sons, 2000

Semester II			
Core VIII	**Research Methodology**		
Course Code: 24PMAC24	**Hrs/ week: 5**	**Hrs/Semester: 75**	**Credits: 4**

Course Objectives

- To contribute to the development of the new statistical methodology to address substantive problems and to promote the use of these methods through publications.
- To identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research projects.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Recognize the nature of research, its objectives, methodologies, and significance in academia and beyond.	K1
CO-2	Understand the role of computers as invaluable tools for assignment and thesis writing, , manage references, and create visually appealing documents.	K2
CO-3	Execute plan and write a thesis, from selecting a topic to producing a final product that meets academic standards and contributes knowledge in their field of study.	K3
CO-4	Support ethical and responsible research practices to uphold academic integrity and avoid plagiarism in academic writing.	K4
CO-5	Justify mathematical ideas effectively through written language, particularly in the context of theorem statements, proofs, and mathematical discourse in discrete mathematics.	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**
CO-2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**
CO-3	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**
CO-4	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO-5	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
Ave.	**3**	**2.8**	**2.6**	**2.2**	**2**	**3**	**2.8**	**2.6**	**2.4**	**2.4**

Semester II			
Core VIII	**Research Methodology**		
Course Code: 24PMAC24	**Hrs/ week: 5**	**Hrs/Semester: 75**	**Credits: 4**

Unit I

An Introduction: Meaning of Research - Objectives of Research – Motivation of Research - Types of Research - Research approaches - Significance of Research - Research methods versus Methodology - Research and scientific method - Importance of knowing how research is done - Research Process - Criteria of Good Research.

Text Book: 1, Chapter: 1

Unit II

Computer Tools for writing and Publishing: Text tools - Publishing and Printing Tools - Management and Presentation Tools - An invaluable tool for assignment and thesis writing. The computer as an information tool: Electronic Information resources – The internet and World WideWeb - Indispensable Research Tool.

Text Book: 2, Chapter: 5 and 6

Unit III

Planning the Thesis: Selecting a topic-Criteria for selecting a topic -Reviewing the literature - Designing the study- Ethical Concerns - The chapter outline. Writing the Thesis: The General Format -The preliminaries - The text -The reference material - The final product.

Text Book: 2, Chapter: 3 and 8

Unit IV

Page and Chapter Format - Chapter divisions and subdivisions – Formatting and Style - Sample Thesis page.Revising the Thesis: Editing the final draft-Evaluating the final draft - Proof reading the final printed copy - Plagiarism - What is Plagiarism - Types of Plagiarism- Preventing plagiarism when writing.

Text Book: 2, Chapter: 9 and 15, http://www.plagiarism.org/plagiarism-101/what-is-plagiarism/

Unit V

Writing language of theorem: Introduction and Motivation - Mathematical style - Terminologyand notation (especially in discrete mathematics) - English usage inmathematical writing.

Text Book: 3, Pages 1-31

Text Books

1. C.R. Kothari. *Research Methodology Methods and Techniques*, New Age InternationalPublishers, Second Revised Edition, 2009.
2. Jonathan Anderson & Millicent Poole. A*ssignmentand Thesis Writing*, Wiley, Fourth Edition,2019.
3. Douglas B. West. *The Grammar According to West.*

Book for Reference

1. Leonie Elphinstone and Robert Schweitzer. *How to get a research degree* . A SurivalGuide, Allen and Unwin Publication, 1998.
2. C.R. Kothari & Gaurav Garg, *Research Methodology Methods and Techniques*, New Age InternationalPublishers, Fourth Edition,2020.
3. Ranjit Kumar , *Research Methodology A Step by Step Guide for Beginners*, Pearson Education, Second Education 2005

Semester II			
Discipline Specific Elective II	**Fluid Mechanics**		
Course Code: 24PMAE21	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Course Objectives

- To introduce fundamental aspects of fluid flow behaviour and to develop steady state mechanical energy balance equation for fluid flow systems.
- To estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	define and explain fundamentals of fluid mechanics, which is used inthe applications of Hydraulics.	K1
CO-2	understand basic laws and equations used for analysis of staticand dynamic fluids.	K2
CO-3	apply Archimedes principle to solve numerical exampleson Buoyancy.	K3
CO-4	analyze stability of submerged and floating bodies.	K4
CO-5	evaluate and optimize operational parameters of hydraulicproblems, systems and machines	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO-2	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**2**	2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO-5	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**
Ave.	**2.6**	**2.4**	**2.4**	**2.2**	**2**	**2.8**	**2.4**	**2.2**	**2.4**	**2**

Semester III			
Discipline Specific Elective II	**Fluid Mechanics**		
Course Code: 24PMAE21	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Unit I

Properties of Fluids: Viscosity – Thermodynamic properties – Compressibility and Bulk modulus – Surface Tension and Capillarity

Chapter 1: Sec 1.1 – 1.6

Unit II

Pressure and its measurement: Fluid pressure of a point – Pascal's Law – Pressure variation in a fluid at rest – Absolute, Gauge, Atmospheric and Vacuum Pressure – Measurement of pressure – Simple manometer – Differential Manometer

Chapter 2: Sec 2.1 – 2.7

Unit III

Hydrostatic forces on Surfaces: Total pressure and Centre of Pressure – Vertical Plane Surfaces submerged in liquid – Horizontal Plane Surfaces submerged in liquid – Inclined Plane Surface submerged in liquid

Chapter 3: Sec 3.1-3.5

Unit IV

Buoyancy and flotation: Buoyancy – Centre of Buoyancy – Meta-centre – Metacentric height – Conditions of Equilibrium of a Floating and Submerged bodies

Chapter 4: Sec 4.1 – 4.7

Unit V

Dimensional and Model Analysis – Secondary or Derived Quantities – Dimensional Homogeneity – Methods of Dimensional Analysis – Model Analysis

Chapter 12: Sec 12.1 – 12.5

Text Book

1. Dr.R.K. Bansal. *A text book of Fluid Mechanics*. Laxmi Publication private limited,Tenth edition, 2019.

Books for Reference

1. Joseph H.Spurk, NuriAksel. *Fluid Mechanics*. Springer- Verlag Berlin Heidelberg, Second Edition, 2008.
2. Ranald V. Giles. *Fluid Mechanics and Hydraulics*. McGraw - Hill Book Company, Fourth Edition, 2013.
3. RK Rajput, A Textbook of Fluid Mechanics, S.Chand and Company Limited, New Delhi, 2019.

Semester - II			
Discipline Specific Elective II	**Wavelet Analysis**		
Course Code: 24PMAE22	**Hrs/week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Course Objectives

- To establish the theory necessary to understand and use wavelets and related constructions
- To apply wavelets, filter banks and multi irresolution techniques to a problem.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand wavelet basis and characterize continuous and discrete wavelet transform	K1
CO-2	understand multi resolution analysis and identify various wavelets and evaluate their time frequency resolution properties	K2
CO-3	analyze discrete wavelet transforms with multivariate digital filters	K3
CO-4	discuss and explain the main merits and limitations of wavelet analysis	K4
CO-5	explain the properties and applications of wavelet transform	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO-2	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO-4	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO-5	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**
Ave.	**2.6**	**2.4**	**2.2**	**2**	**2**	**2.8**	**2.4**	**2.4**	**2.2**	**2.6**

Semester - II			
Discipline Specific Elective III	**Wavelet Analysis**		
Course Code: 24PMAE22	**Hrs/week: 5**	**Hrs/Sem: 75**	**Credits: 3**

Unit I

Motivation and Heuristics - Heuristics Treatment of the Wavelet Transform - Wavelet Transform - Wavelet Characterization of Smoothness - Haar Wavelet Expansion - Haar Functions and Haar Series - Haar Sums and Dyadic Projections - Completeness of the Haar Functoins.

(Chapter: 6, Sec: 6.1 - 6.3, except 6.3.4 - 6.3.7)

Unit II

Multi resolution Analysis - Orthonormal System and Riesz Systems - Scaling Equations and Structure Constants - From Scaling Function to MRA - Meyer Wavelets - From Scaling Function to Orthonormal Wavelet.

(Chapter: 6, Sec 6.4)

Unit III

Wavelets with Compact Support - From Scaling Filter to Scaling Function - Explicit Construction of Compact Wavelets - Smoothness of Wavelets - Cohen's Extension

(Chapter: 6, Sec: 6.5)

Unit IV

Convergence Properties of Wavelet Expansions - Wavelet Series in L^P Spaces - Jackson and Bernstein Approximation Theorems.

(**Chapter: 6, Sec: 6.6)**

Unit V

Wavelets in Several Variables - Two important Examples - General Formulation of MRA and Wavelets in R^d - Examples of Wavelets in R^d.

(Chapter: 6, Sec: 6.7)

Text Book:

1. Mark A. Pinsky. *Introduction to Fourier Analysis and Wavelets*. Published by the American Mathematical Society, First Indian Edition, 2015.

Books for Reference:

1. E. Hernandez and G. Weiss. *A First Course on Wavelets*. CRC Press, 1996.
2. L. Prasad & S.S. Iyengar. *Wavelet Analysis with Applications to Image Processing.* CRC Press, 1997.
3. D.Walnut's . *An Introduction to Wavelet Analysis: Mathematics*, Springer (India),2008.

Semester II			
Skill Enhancement Course II	**Statistics Using R Programming**		
Course Code: 24PMASE2	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Course Objectives

- To analysis data for the purpose of exploration using Descriptive and Inferential Statistics
- To learn the creative application of Regression.

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	understand the fundamentals of R- Programming ,Math Functions	K1
CO-2	demonstrate simulation in R- Programming	K2
CO-3	know the principals of Graphics	K3
CO-4	develop application and performing T- Test and other relevant test	K4
CO-5	design and build Linear Model	K5

PSO Relation Matrix–Table

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**
CO-2	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO-3	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**
CO-4	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**
CO-5	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
Ave.	3	2.2	3	2.8	2	2.8	2.4	2.4	2.6	2.6

Semester II			
Skill Enhancement Course II	**Statistics using R Programming**		
Course Code: 24PMASE2	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Unit I

Introduction, How to run R, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes. R programmingStructures, Control Statements, Loops – Looping Over Non vector Sets- If – Else , Arithmetic and Boolean Operators and Value- Functions.

Unit II

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Reading and writer Files.

Unit III

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

Unit IV

Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

Unit V

Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests.

Text Books

1. Jared P. Lander, *R for Everyone*, Pearson Education , 2014
2. The Art of R Programming, Norman Matloff, No starch Press , 2011

Books for Reference

1. Paul Teetor, *R Cookbook,* O'reilly, First Edition 2011.
2. Robert I.Kabacoff, *R in Action*, Manning Publication. 20 May 2015
3. KG Srinivasa, G.M. Siddesh,Chetan Shetty, B.J. Sowmya, *Statistical Programming in R* , 1st Edition , 5 June 2017