Marudhar Kesari Jain College for Women, Vaniyambadi
PG & Research Department of Mathematics
PG-Mathematics Curriculum frame work

**Semester– I**

| Code | Course Title | Hours Distribution | | | | C |
|---|---|---|---|---|---|---|
| | | L | T | P | S | |
| 24PMAC11 | CC-1Algebraic Structure | 2 | 1 | 1 | 1 | 4 |
| 24PMAC12 | CC-2 Real Analysis I | 3 | 1 | 1 | 1 | 4 |
| 24PMAC13 | CC-3 Ordinary Differential Equations | 2 | 1 | 1 | 1 | 3 |
| 24PMAE11/ 24PMAE12 | EC-1 Graph Theory and Applications / Number Theory and Cryptography | 2 | 1 | 1 | 1 | 3 |
| 24PMAE13/ 24PMAE14 | EC-2 Discrete Mathematics /Fuzzy Sets and theirApplications | 2 | 1 | 1 | 1 | 3 |
| 24PMAA11 | AECC –1 Mathematical Documentation Using LATEX | 1 | 0 | 1 | 0 | 2 |
| 24PCHR11 | VE-1 Human Rights | 1 | 1 | 0 | 0 | 2 |
| | | | | | **30** | **21** |

**Semester- II**

| Code | Course Title | Hours Distribution | | | | C |
|---|---|---|---|---|---|---|
| | | L | T | P | S | |
| 24PMAC21 | CC-4 Advanced Algebra | 3 | 1 | 0 | 1 | 4 |
| 24PMAC22 | CC-5 Real Analysis II | 3 | 1 | 0 | 1 | 4 |
| 24PMAC23 | CC-6 Partial Differential Equations | 2 | 1 | 1 | 1 | 3 |
| 24PMAC24 | CC–7 Difference Equations | 2 | 1 | 1 | 1 | 3 |
| 24PMAE21/ 24PMAE22 | EC-3 Tensor Analysis and Relativity Theory /Mathematical Statistics | 2 | 1 | 0 | 1 | 3 |
| 24PMAE23/ 24PMAE24 | EC-4 Machine Learning /Neural Networks | 2 | 1 | 0 | 1 | 3 |
| 24PMAS21 | SEC -1(NME) Numerical Methods | 1 | 0 | 1 | 0 | 2 |
| | | | | | **30** | **22** |

**Semester–III**

| | | | | | | |
|---|---|---|---|---|---|---|
| 24PMAC31 | CC-8 Complex Analysis | 3 | 1 | 1 | 1 | 5 |
| 24PMAC32 | CC-9 Probability Theory | 3 | 1 | 1 | 1 | 4 |
| 24PMAC33 | CC-10 Topology | 3 | 1 | 0 | 1 | 4 |
| 24PMAC34 | CC-11 Mechanics | 3 | 1 | 1 | 1 | 4 |
| 24PMAE31 /24PMAE32 | EC-5 Fluid Dynamics/ Algebraic Number Theory | 2 | 0 | 1 | 1 | 3 |
| 24PMAS31 | SEC–2 Research Tools and Techniques | 2 | 0 | 0 | 1 | 2 |
| 24PMAIN31 | Internship | 0 | 0 | 0 | 0 | 2 |
| | | | | | **30** | **24** |

**Semester-IV**

| | | | | | | |
|---|---|---|---|---|---|---|
| | CC-12 Functional Analysis | 3 | 1 | 1 | 1 | 5 |
| | CC-13 Differential Geometry | 3 | 1 | 1 | 1 | 5 |
| | CC-14 Project | 0 | 0 | 5 | 1 | 5 |
| | EC-6 Resource Management Techniques / Financial Mathematics | 2 | 1 | 1 | 1 | 4 |
| | PEC-1 Stochatic Process | 2 | 0 | 0 | 1 | 2 |
| | SLC-1Mathematical Modelling | 2 | 0 | 1 | 1 | 2 |
| | | | | | | |
| | | | | | **30** | **23** |
| | **TotalCredits** | **90+2*** | | | | |

Students must complete at least one online course (MOOC) from plat forms like SWAYAM, NPTEL, or Nanmudalvan with in the fifth semester. Additionally, engaging in a specified Self-learning Course is mandatory To qualify for the degree, and successful participation will be acknowledged with an extra creditof2*.

| | | |
|---|---|---|
| CC | CoreCourse | 14 |
| EC | ElectivePaper | 6 |
| SEC | SkillEnhancementCourse | 2 |
| AEC | AbilityEnhancementCompulsoryCourses | 1 |
| VE | ValueEducations | 1 |
| | Internship | 1 |
| PEC | ProfessionalEnhancementCourse | 1 |
| SLC | Self-LearningCourse | 1 |

## II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAC31 | Complex Analysis | Core Course-8 | 3 | 1 | 1 | 1 | 5 | 6 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| LO1 | To analyze and evaluate local properties of analytical functions and definite |
| LO2 | To demonstrate the concept of the general form of Cauchy's theorem. |
| LO3 | To describe the concept of definite integral and harmonic functions. |
| LO4 | To develop Taylor and Laurent series |
| LO5 | To learn the infinite products, canonical products and Jensen's formula. |

| Unit | Content | Hours |
|---|---|---|
| 1 | **Cauchy's Integral Formula**<br>The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytical Functions: Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.<br>**Chapter 4 : Section 2 : 2.1 to 2.3**<br>**Chapter 4 : Section 3 : 3.1 to 3.4** | 18 |
| 2 | **The General form of Cauchy's Theorem**<br>Chains and cycles- Simple Connectivity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multiply connected regions - Residue theorem – The argument principle.<br>**Chapter 4 : Section 4 : 4.1 to 4.7**<br>**Chapter 4 : Section 5: 5.1 and 5.2** | 18 |
| 3 | **Evaluation of Definite Integrals and Harmonic Functions**<br>Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.<br>**Chapter 4 : Section 5 : 5.3**<br>**Chapter 4 : Sections 6 : 6.1 to 6.3** | 18 |
| 4 | **Harmonic Functions and Power Series Expansions**<br>Schwarz theorem - The reflection principle – Weierstras's theorem –Taylor's Series – Laurent series.<br>**Chapter 4 : Sections 6:6.4 and 6.5**<br>**Chapter 5 : Sections 1:1.1 to 1.3** | 18 |
| 5 | **Partial Fractions and Entire Functions**<br>Partial fractions -Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem.<br>**Chapter 5 : Sections 2: 2.1 to 2.4**<br>**Chapter 5 : Sections 3:3.1 and 3.2** | 18 |
| | **Total** | 90 |

**Theory 80% Problem- 20%**

| CO | Course Outcomes<br>**The Students will be able to** |
|---|---|
| CO1 | Analyze and evaluate local properties of analytical functions and definite integrals |
| CO2 | Work out on general form of Cauchy's theorem and multiply connected regions |
| CO3 | Evaluate definite integral and harmonic functions. |
| CO4 | Apply Taylor and Laurent series. |
| CO5 | Examine the infinite products, canonical products and Jensen's formula. |
| **Textbooks:** | |
| 1 | Lars V. Ahlfors, *Complex Analysis*, (3rd edition) McGraw Hill Co., New York, 1979 |
| **Reference Books:** | |
| 1 | H.A. Presfly, *Introduction to complex Analysis*, Clarendon Press, oxford, 1990 |
| 2 | J.B. Conway, *Functions of one complex variables* Springer - Verlag, International student Edition, Narosa Publishing Co.1978 |
| 3 | E.Hille, *Analytic function Theory* (2 vols.), Gonm and Co, 1959. |
| 4 | M.Heins, *Complex function Theory*, Academic Press, New York, 1968. |
| 5 | James Ward Brown, R.V. Churchil, *Complex Variables and Applications*, McGraw Hill Education Private Limited,8th Edition, 2014 |
| **Web resources:** | |
| 1 | http://mathforum.org |
| 2 | http://www.opensource.org |
| 3 | http://en.wikipedia.org |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| **CO2** | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| **Total** | 13 | 10 | 14 | 11 | 15 | 15 | 11 | 13 | 15 | 10 | 12 |
| **Average** | 2.6 | 2 | 2.8 | 2.5 | 3 | 3 | 2.5 | 2.6 | 3 | 2 | 2.4 |

**3 – Strong, 2- Medium, 1- Low**

# II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAC32 | Probability Theory | Core Course-9 | 3 | 1 | 1 | 1 | 4 | 6 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| LO1 | To understand Random Events, Random Variables, to describe Probability, to apply Baye's to define Distribution Function, to find Joint Distribution function, Marginal Distribution and Conditional Distribution function. |
| LO2 | To define Expectation, Moments and Chebyshev's Inequality, to solve Regression of the first and second types. |
| LO3 | To learn Characteristic functions, distribution function, to find probability generating functions |
| LO4 | To describe One point, two-point Binomial distributions, to solve problems of Hyper geometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions. |
| LO5 | To discuss Stochastic convergence, Bernaulli's law of large numbers, to elaborate Convergence of sequence of distribution functions, to prove Levy-Cramer Theorems and de Moivre-Laplace Theorems, to explain Poisson, Chebyshev's, Khintchine Weak law of large numbers, to explain and solve problems on Kolmogorov Inequality and Kolmogorov Strong Law of large numbers. |

| Unit | Content | Hours |
|---|---|---|
| 1 | **Random Events and Random Variables**<br>Random events –Probability axioms – Combinatorial formulae – conditional probability –Baye's Theorem – Independent events – Random Variables –Distribution Function – Joint Distribution – Marginal Distribution –Conditional Distribution – Independent random variables – Functions of random variables.<br>**Chapter 1: Sections 1.1 to 1.7**<br>**Chapter 2 : Sections 2.1 to 2.9** | 18 |
| 2 | **Parameters of the Distribution**<br>Expectation- Moments –The Chebyshev's Inequality – Absolute moments – Order parameters –Moments of random vectors – Regression of the first and second types.<br>**Chapter 3 : Sections 3.1 to 3.8** | 18 |
| 3 | **Characteristic functions**<br>Properties of characteristic functions – Characteristic functions and moments – semi invariants –characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function –Characteristic function of multidimensional random vectors –Probability generating functions.<br>**Chapter 4 : Sections 4.1 to 4.7** | 18 |
| 4 | **Some Probability distributions**<br>One point and two point distribution ,Binomial – Polya – Hypergeometric – Poisson (discrete) distributions –Uniform – normal- gamma – Beta – Cauchy and Laplace (continuous) distributions.<br>**Chapter 5 : Section 5.1 to 5.10** | 18 |

| | | |
|---|---|---|
| 5 | **Limit Theorems**<br>Stochastic convergence – Bernaulli's law of large numbers – Convergence of sequence of distribution functions –Levy-Cramer Theorems – De Moivre-Laplace Theorem – Poisson, Chebyshev's, Khintchine Weak law of large numbers – Lindberg Theorem – Lapunov Theroem – Borel-Cantelli Lemma – Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.<br>**Chapter 6: Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12. (Omit Sections 6.5, 6.10)** | 18 |
| | **Total** | **90** |
| **Theory 80% Problem 20%** | | |

| **CO** | **Course Outcomes**<br>**The Students will be able to** |
|---|---|
| CO1 | Apply Random Events, Random Variables and distribution functions. |
| CO2 | Work on Expectation, Moments and Chebyshev's Inequality and Regression types. |
| CO3 | Determine Characteristic functions, distribution function and probability generating functions |
| CO4 | Solve problems on Binomial distributions, Hypergeometric and Poisson distributions. |
| CO5 | Evaluate Stochastic convergence, Bernaulli law of large numbers, Kolmogorov Inequality and Kolmogorov Strong Law of large numbers. |
| **Textbooks:** | |
| 1 | M.Fisz, *Probability Theory and Mathematical Statistics*, John Wiley and Sons, New York,1963. |
| **Reference Books:** | |
| 1 | R.B. Ash, *Real Analysis and Probability*, Academic Press, New York, 1972 |
| 2 | K.L. Chung, *A course in Probability*, Academic Press, New York, 1974 |
| 3 | R.Durrett, *Probability: Theory and Examples*, (2nd Edition) Duxbury Press, New York, 1996. |
| 4 | V.K. Rohatgi, *An Introduction to Probability Theory and Mathematical Statistics*, WileyEastern Ltd., New Delhi, 1988(3rd Print). |
| 5 | S.I. Resnick, *A Probability Path*, Birhauser, Berlin, 1999. |
| **Web resources:** | |
| 1 | http://mathforum.org// |
| 2 | www.opensource.org// |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| **CO2** | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| **Total** | 13 | 10 | 14 | 11 | 15 | 15 | 11 | 13 | 15 | 10 | 12 |
| **Average** | 2.6 | 2 | 2.8 | 2.5 | 3 | 3 | 2.5 | 2.6 | 3 | 2 | 2.4 |

**3 – Strong, 2- Medium, 1- Low**

# II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAC33 | Topology | Core Course-10 | 3 | 1 | 0 | 1 | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| LO1 | To define and illustrate the concept of topological spaces, open sets, neighbourhood, interior, exterior, closure and their axioms. |
| LO2 | To understand continuity, compactness, connectedness, homeomorphism and topological properties. |
| LO3 | To analyze and apply the topological concepts in Functional Analysis |
| LO4 | To determine a point in a topological space is either a limit point or not for a given subset of a topological space. |
| LO5 | To develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent (homeomorphic). |

| Unit | Content | Hours |
|---|---|---|
| 1 | **Topological spaces**<br>Topological spaces – Basis for a topology – The order topology – The product topology on X × Y – The subspace topology – Closed sets and limit points.<br>**Chapter 2 : Sections 12 to 17** | 15 |
| 2 | **Continuous functions**<br>Continuous functions – The product topology – The metric topology.<br>**Chapter 2 : Sections 18 to 21** | 15 |
| 3 | **Connectedness**<br>Connected spaces- connected subspaces of the Real line – Components and local connectedness.<br>**Chapter 3: Sections 23 to 25.** | 15 |
| 4 | **Compactness**<br>Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness**.**<br>**Chapter 3: Sections 26 to 29.** | 15 |
| 5 | **Countability and Separation Axiom:**<br>The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohn Metrization Theorem – The Tietze extension theorem.<br>**Chapter 4 : Sections 30 to 35.** | 15 |
| | **Total** | 75 |

**Theory 100%**

| CO | Course Outcomes<br>**The Students will be able to** |
|---|---|
| CO1 | Study the concept of topological spaces, open sets, neighbourhood, interior, exterior, closure and their axioms. |
| CO2 | Understand continuity, compactness, connectedness, homeomorphism and topological properties |
| CO3 | Apply the topological concepts in Functional Analysis |
| CO4 | Evaluate whether a point in a topological space is either a limit point or not for a given subset of a topological space |
| CO5 | Review qualitative tools to characterize connectedness, compactness, second countable, Hausdorff. |
| **Textbooks:** | |
| 1 | James R. Munkres, *Topology* (2nd Edition) Pearson Education Private. Ltd., Delhi-2010 (Third Indian Reprint) |
| **Reference Books:** | |
| 1 | J.Dugundji, *Topology* , Prentice Hall of India, New Delhi, 1975. |
| 2 | George F.Simmons, *Introduction to Topology and Modern Analysis*, McGraw Hill Book Co., 1963 |
| 3 | J.L. Kelly, *General Topology*, Van Nostrand, Reinhold Co., New York. |
| 4 | L.Steen and J.Subhash, *Counter Examples in Topology*, Holt, Rinehart and Winston, New York,1970. |
| 5 | S.Willard, *General Topology*, Addison - Wesley, Mass., 1970 |
| **Web resources:** | |
| 1 | http://mathforum.org |
| 2 | http://www.opensource.org |
| 3 | http://en.wikipedia.org |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO2** | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| **Total** | 13 | 10 | 15 | 11 | 15 | 15 | 15 | 10 | 15 | 10 | 12 |
| **Average** | 2.6 | 2 | 3 | 2.2 | 3 | 3 | 3 | 2 | 3 | 2 | 2.4 |

**3 – Strong, 2- Medium, 1- Low**

## II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAC34 | Mechanics | Core Course-11 | 3 | 1 | 1 | 1 | 4 | 6 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To understand mechanical systems under generalized coordinate systems |
| LO2 | To apply mechanics techniques in virtual work-Lagrange Equations |
| LO3 | To develop students ability to deal with Energy and momentum |
| LO4 | To learn the concept of Hamilton -Jacobi Theory. |
| LO5 | To discuss the Canonical Transformation. |

| Unit | Content | Hours |
|---|---|---|
| 1 | **Mechanical Systems**<br>The Mechanical system-Generalized coordinates- Constraints-Virtual work– Energy and Momentum.<br>**Chapter1: Sections 1.1 to 1.5** | 18 |
| 2 | **Lagrange's Equations**<br>Derivation of Lagrange's equations- Examples - Integrals of motion.<br>**Chapter 2: Sections 2.1 to 2.3** | 18 |
| 3 | **Hamilton's Equations**<br>Hamilton's Principle - Hamilton's Equation - Other variational principles.<br>**Chapter4: Sections 4.1 to 4.3** | 18 |
| 4 | **Hamilton-Jacobi Theory**<br>Hamilton's Principle function-Hamilton-Jacobi Equation-Separability.<br>**Chapter5: Sections 5.1 to 5.3** | 18 |
| 5 | **Canonical Transformation**<br>Differential forms and generating functions - Lagrange and Poisson brackets.<br>**Chapter 6: Sections 6.1 , 6.3 (Omit 6.2)** | 18 |
| | **Total** | 90 |

**Theory 80% Problem 20%**

| CO | Course Outcomes<br>**The Students will be able to** |
|---|---|
| CO1 | Understand mechanical systems under generalized coordinate systems |
| CO2 | Apply mechanical techniques in virtual work by Lagrange |
| CO3 | Evaluate energy and momentum in Hamilton's Equations |
| CO4 | Understand Hamilton-Jacobi theory |
| CO5 | Work on Canonical Transformation. |
| **Textbooks:** | |
| 1 | D.T. Greenwood, *Classical Dynamics*, Prentice Hall of India, New Delhi, 1985. |
| **Reference Books:** | |
| 1 | H.Goldstein, *Classical Mechanics*,(2nd Edition) Narosa Publishing House, New Delhi,1950. |
| 2 | N.C.Raneand P.S.C.Joag, *Classical Mechanics*, Tata McGraw Hill, 1991. |
| 3 | J.L.Synge and B.A. Griffth, *Principles of Mechanics* (3rd Edition) McGraw Hill Book Co.,New York, 1970. |
| 4 | French and Ebison, *Introduction to Classical Mechanics*, Kluwer Academic Publishers |
| 5 | George Hrabovsky, *Classical Mechanics*, Penguin Books |
| **Web resources:** | |
| 1 | https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/ |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO2** | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| **CO4** | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 |
| **Total** | 13 | 13 | 11 | 13 | 12 | 10 | 12 | 13 | 12 | 14 | 12 |
| **Average** | 2.6 | 2.6 | 2.2 | 2.6 | 2.4 | 2 | 2.4 | 2.6 | 2.4 | 2.8 | 2 |

**3 – Strong, 2- Medium, 1- Low**

# II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAE31 | Fluid Dynamics | Elective Course-V | 2 | 0 | 1 | 1 | 3 | 4 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| LO1 | To understand the concepts of kinematics of fluids in motions |
| LO2 | To find the pressure at a point in a moving fluid |
| LO3 | To discuss Stokes stream function. |
| LO4 | To analyze complex velocity potential for two dimensional flows |
| LO5 | To derive the Navier – Stokes equations of motion of a Viscous fluid |

| Unit | Content | Hours |
|---|---|---|
| 1 | **Kinematics of Fluids in Motion**<br>Real fluids and ideal fluids – Velocity of a fluid at a point, Stream lines, path lines, steady and unsteady flows –The Velocity potential –The vorticity vector – Local and particle rates of changes –Equations of continuity – Worked examples.<br>**Chapter 2: Sections 2.1 to 2.8** | 12 |
| 2 | **Equations of Motion of a Fluid**<br>Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary of two inviscid immiscible fluids – Euler's equation of motion –Discussion of the case of steady motion under conservative body forces.<br>**Chapter 3: Sections 3.1 to 3.4 and 3.7** | 12 |
| 3 | **Some Three Dimensional Flows**<br>Introduction – Sources, sinks and doublets – Images in a rigid infinite plane –Axis symmetric flows – Stokes stream function.<br>**Chapter 4: Sections 4.1- 4.3, 4.5** | 12 |
| 4 | **Some Two Dimensional Flows**<br>The stream function – The complex potential for two dimensional, irrational incompressible flow –Complex velocity potentials for standard two dimensional flows – Some worked examples – Two dimensional image systems –The Milne Thompson circle Theorem.<br>**Chapter 5: Sections 5.3 to 5.8** | 12 |
| 5 | **Viscous Flows**<br>Stress components in a real fluid – Relations between Cartesian components of stress – Translational motion of fluid element –The co-efficient of viscosity and Laminar flow – The Navier –Stokes equations of motion of a Viscous fluid.<br>**Chapter 8: Sections 8.1 to 8.3, 8.8 and 8.9** | 12 |
| | **Total** | 60 |

**Theory- 60%, Problem-40%**

| CO | Course Outcomes<br>**The Students will be able to** |
|---|---|
| CO1 | Understand the concepts of kinematics of fluids in motions. |
| CO2 | Evaluate the pressure at a point in a moving fluid |
| CO3 | Work on Stokes stream function intrinsic |
| CO4 | Analyze complex velocity potential for two dimensional flows |
| CO5 | Solve the Navier – Stokes equations of motion of a Viscous fluid |
| **Textbooks:** | |
| 1 | F.Chorlton, *Text Book of Fluid Dynamics*, CBS Publications. Delhi, 1985 |
| **Reference Books:** | |
| 1 | R.W.Fox and A.T.McDonald. *Introduction to Fluid Mechanics*, Wiley, 1985. |
| 2 | E.Krause, *Fluid Mechanics with Problems and Solutions*, Springer, 2005. |
| 3 | B.S.Massey, J.W.Smith and A.J.W.Smith, *Mechanics of Fluids*, Taylor and Francis, New York, 2005 . |
| 4 | P.Orlandi, *Fluid Flow Phenomena*, Kluwer, New Yor, 2002. |
| 5 | T.Petrila, *Basics of Fluid Mechanics and Introduction to Computational Fluid Dynamics*, Springer,Berlin, 2004. |
| **Web resources:** | |
| 1 | http://web.mit.edu/1.63/www/lecnote.html |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 |
| **Total** | 15 | 15 | 14 | 12 | 14 | 12 | 13 | 13 | 13 | 13 | 14 |
| **Average** | 3 | 3 | 2.8 | 2.4 | 2.8 | 2.4 | 2.6 | 2.6 | 2.6 | 2.6 | 2.8 |

**3 – Strong, 2- Medium, 1- Low**

## II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAE32 | Algebraic Number Theory | Elective Course-V | 2 | 0 | 1 | 1 | 3 | 4 | 25 | 75 | 100 |

| Learning Objectives | |
|---|---|
| LO1 | To learn about rings, fields and factorization of polynomials. |
| LO2 | To know about norms and traces over ring of integers |
| LO3 | To understand factorization to irreducible polynomials. |
| LO4 | To study on Euclidean Quadratic fields |
| LO5 | To analysis concepts of ideals. |

| Unit | Content | Hours |
|---|---|---|
| 1 | **Algebraic Background**<br>Rings and Fields- Factorization of Polynomials - Field Extensions - Symmetric Polynomials - Modules - Free Abelian Groups.<br>**Chapter 1: Sec. 1.1 to 1.6** | 12 |
| 2 | **Algebraic Numbers**<br>Algebraic numbers - Conjugates and Discriminants - Algebraic Integers - Integral Bases - Norms and Traces - Rings of Integers.<br>**Chapters 2: Sec. 2.1 to 2.6** | 12 |
| 3 | **Quadratic and Cyclotomic Fields**<br>Quadratics and cyclotomatic fields : Factorization into irreducibles: Trivial factorization - Factroization into irreducibles - Examples of nonunique factorization into irreducibles.<br>**Chapter 3: Sec. 3.1 and 3.2 ; Chapter 4: Sec. 4.2 to 4.4** | 12 |
| 4 | Prime Factroization - Euclidean Domains - Euclidean Quadratic fields - Consequences of unique factorization - The Ramanujan –Nagell Theorem.<br>**Chapter 4: Sec. 4.5 to 4.9** | 12 |
| 5 | **Ideals**<br>Prime Factorization of Ideals - The norms of an Ideal - Non-unique Factorization in Cyclotomic Fields..<br>**Chapter 5 : Sec. 5.2 to 5.4** | 12 |
| | **Total** | 60 |

**Theory-90% Problem-10%**

| CO | Course Outcomes<br>**The Students will be able to** |
|---|---|
| CO1 | Study about rings, fields and factorization of polynomials. |
| CO2 | Recall on norms and traces over ring of integers. |
| CO3 | Solve factorization to irreducible polynomials. |
| CO4 | Understand Euclidean Quadratic fields |
| CO5 | Work on concepts of ideals. |
| **Textbooks:** | |
| 1 | Steward and D.Tall. *Algebraic Number Theory and Fermat's Last Theorem* (3rd Edition) A.K.Peters Ltd., Natrick, Mass. 2002.. |
| **Reference Books:** | |
| 1 | Z.I.Bosevic and I.R.Safarevic, *Number Theory*, Academic Press, New York, 1966 |
| 2 | J.W.S.Cassels and A.Frohlich, *Algebraic Number Theory*, Academic Press, New York, 1967 |
| 3 | R J.W.S.Cassels and A.Frohlich, *Algebraic Number Theory*, Academic Press, New York, 1967 |
| 4 | P.Samuel, *Algebraic Theory of Numbers*, Houghton Mifflin Company, Boston, 1970. |
| 5 | A.Weil. *Basic Number Theory*, Springer, New York, 1967. |
| **Web resources:** | |
| 1 | http://mathforum.org// |
| 2 | http://www.opensource.org// |
| 3 | www.mathpages.com// |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Total** | 15 | 12 | 14 | 14 | 14 | 15 | 14 | 13 | 15 | 13 | 15 |
| **Average** | 3 | 2.4 | 2.8 | 2.8 | 2.8 | 3 | 2.8 | 2.6 | 3 | 2.6 | 5 |

**3 – Strong, 2- Medium, 1- Low**

# II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAS31 | Research Tools And Techniques | SEC-II | 2 | 0 | 1 | 1 | 2 | 3 | 25 | 75 | 100 |

| Learning Objectives | |
|---|---|
| LO1 | To demonstrate the knowledge of Research methodology and research problem |
| LO2 | To create the knowledge on Research Design |
| LO3 | To learn the concept of measurement and scaling |
| LO4 | To analyze the data. |
| LO5 | To formulate the hypothesis and to learn the concept of critical value |

| Unit | Content | Hours |
|---|---|---|
| 1 | Research Methodology- Meaning-Objectives- Types- Methods. Research Problem-Definition-Techniques.<br>**Chapter 1: Section:1.1 to 1.8**<br>**Chapter 2: Section:2.1 to 2.4** | 9 |
| 2 | Research Design-Meaning,-Features- Concepts- types- principles- Different Research Design- Principles and experimental design<br>**Chapter 3: Section:3.1 to 3.7** | 9 |
| 3 | Measurement and Scaling-Qualitative and quantitative data- Classification, Techniques, Scaling-Classification.<br>**Chapter 5: Section:5.1 to 5.7** | 9 |
| 4 | Data Collection-Introduction-Experiments and survey -Primary and Secondary data<br>**Chapter 6: Section:6.1 to 6.4** | 9 |
| 5 | Testing of Hypothesis-Basic concepts-Critical region and critical value – Procedure.<br>**Chapter 10: Section:10.1 to 10.6** | 9 |
| | **Total** | 45 |

**Theory-100%**

| CO | Course Outcomes<br>**The Students will be able to** |
|---|---|
| CO1 | Understand the knowledge of Research methodology and research problem. |
| CO2 | Frame the Research Designs. |
| CO3 | Work on measurement and scaling. |
| CO4 | Able to collect and classify the data |
| CO5 | Formulate the hypothesis and learnt the concept of critical value. |

**Textbooks:**

| | |
|---|---|
| 1 | C.R.Kothari, Gaurav Garg, *Research Methodology Methods and Techniques*, New AgeInternational Publishers, 2019. |

| **Reference Books:** | |
|---|---|
| 1 | Dr. Prabhat Pandey Dr. Meenu Mishra Pandey ,*Research Methodology: Tools and Techniques*, Bridge Center, 2015 |
| 2 | Ackoff, Russell L. *The Design of Social Research*, University of Chicago Press: Chicago, 1961 |
| 3 | Allen, T. Harrell, *New Methods in Social Research*, Praeger Publication: New York, 197 |
| 4 | Baker, R.P. and Howell, A.C. *The Preparation of Reports*, Ronald Press: New York, 1958. |
| 5 | Barzun, Jacques and Graff. F. *The Modern Researcher*, Harcourt, Brace Publication: New York, 1990 |
| **Web resources:** | |
| 1 | http://mathforum.org// |
| 2 | http://www.opensource.org// |
| 3 | www.mathpages.com// |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| **CO5** | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 |
| **Total** | 12 | 12 | 13 | 15 | 13 | 14 | 14 | 12 | 13 | 13 | 14 |
| **Average** | 2.4 | 2.4 | 2.6 | 3 | 2.6 | 2.8 | 2.8 | 2.4 | 2.6 | 2.6 | 2. 8 |

**3 – Strong, 2- Medium, 1- Low**

## II YEAR: THIRD SEMESTER

| Course Code | Course Name | Category | L | T | P | S | Credits | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| 24PMAIN31 | **Internship** | | **0** | **0** | **0** | **0** | **2** | **25** | **25** | **75** | **100** |

| **Learning Objectives** | |
|---|---|
| LO1 | Engage in a professional working environment to gain hands-on experience and understand the practical applications of theoretical knowledge. |
| LO2 | Analyze various aspects of developing computer-based solutions while fostering teamwork and collaboration. |
| LO3 | Demonstrate proficiency in problem-solving, soft skills, and other essential abilities required for professional growth and development. |
| LO4 | Develop additional competencies and specialized skills relevant to a chosen occupation or profession. |
| LO5 | Enhance interpersonal, social, and communication skills to promote effective workplace interaction. |

| | **REGULATIONS** | |
|---|---|---|
| 1 | Every student must complete an internship program in a relevant firm, industry, or organization during the course of study to gain practical exposure. | |
| 2 | After completing the second semester, the student should identify and analyze a suitable project to be undertaken during the third semester. | |
| 3 | During the internship, students are expected to actively participate in assigned tasks and document the work performed throughout the training period. | |
| 4 | A detailed internship report must be prepared and submitted by the student in the format prescribed by the institution. | |
| 5 | The report submission will take place at the end of the third semester, followed by presentation and viva voce evaluation during the semester examination. | |
| 6 | The evaluation of the internship/project work will be for 100 marks, comprising 50 internal (25 for report and 25 for viva) and 50 externals (25 for report and 25 for viva), assessed jointly by internal and external examiners. The external examiner shall be appointed from affiliated colleges or, if necessary, from within the college. | |
| 7 | Students must secure at least 50% of the total marks to pass. Those who fail to meet this requirement must improve their performance and resubmit their report in the next available attempt. The final report must include all prescribed sections and be submitted to the Controller of Examinations within the specified date. | |

| CO | COURSE OUTCOMES |
|---|---|
| CO1 | Identify specific areas of interest and enhance relevant skills and competencies |
| CO2 | Cultivate greater self-awareness while fostering respect and appreciation for others. |
| CO3 | Develop professional work habits and attitudes essential for success in the workplace. |
| CO4 | Recognize the significance of effective communication, interpersonal skills, and teamwork. |
| CO5 | Promote proactive preparation to transition internship experiences and creativity into full-time employment immediately upon graduation. |

**Internal Marks Awarded for the Internship – 25 Marks**

| Component | Marks |
|---|---|
| Internship Review I (During the Beginning of The Semester) | 5 Marks |
| Internship Review II (During the End of The Semester) | 15 Marks |
| Progress of The Internship by the Student Participated | 5 Marks |

**External Marks Awarded for the Internship – 75 Marks**

| Component | Marks |
|---|---|
| Evaluation of the Internship Report | 25 Marks |
| Presentation | 25 Marks |
| Viva Voce Examination | 25 Marks |