**KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)**

COIMBATORE – 641 029

Course Name : **M.Sc Mathematics**

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2025-2026 and onwards)

| Semester | Subject Code | Title of the Paper | Instruction hours/cycle | Exam. Marks | | | Duration of Exam (hours) | Credits |
|---|---|---|---|---|---|---|---|---|
| | | | | CIA | ESE | TOTAL | | |
| I | 25PMA101 | Core Paper 1 Algebra | 7 | 25 | 75 | 100 | 3 | 5 |
| | 25PMA102 | Core Paper 2 Real Analysis | 6 | 25 | 75 | 100 | 3 | 4 |
| | 25PMA103 | Core Paper 3 Ordinary Differential Equations | 7 | 25 | 75 | 100 | 3 | 5 |
| | 25PMA104 | Core Paper 4 Numerical Analysis | 6 | 25 | 75 | 100 | 3 | 4 |
| | **25PMA1N1** | **Non-Major Elective 1** | **4** | 25 | 75 | **100** | **3** | **4** |
| | | **Total** | **30** | **-** | **-** | **500** | **-** | **22** |
| II | 25PMA205 | Core Paper 5 Complex Analysis | 7 | 25 | 75 | 100 | 3 | 4 |
| | 25PMA206 | Core Paper 6 Partial Differential Equations | 6 | 25 | 75 | 100 | 3 | 4 |
| | 25PMA207 | Core Paper 7 Mechanics | 6 | 25 | 75 | 100 | 3 | 4 |
| | 25PMA208 | Core Paper 8 Object Oriented Programming with C++ Theory | 5 | 25 | 75 | 100 | 3 | 4 |
| | 25PMA2CL | Core Practical 1 Object Oriented Programming with C++ Practical | 2 | 40 | 60 | 100 | 3 | 2 |
| | **25PGI2N2** | **Non-Major Elective 2*** | **4** | **100** | **-** | **100** | **3** | **4** |
| | | **Total** | **30** | **-** | **-** | **600** | **-** | **22** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **III** | 25PMA309 | Core Paper 9 Topology | 7 | 25 | 75 | 100 | 3 | 5 |
| | 25PMA310 | Core Paper 10 Functional Analysis | 7 | 25 | 75 | 100 | 3 | 5 |
| | 25PMA311 | Core Paper 11 Mathematical Statistics | 7 | 25 | 75 | 100 | 3 | 5 |
| | **25PMA3E1** | **Major Elective 1** | **7** | 25 | 75 | **100** | **3** | **5** |
| | **-** | **EDC Paper** | **2** | **100** | **-** | **100** | **3** | **2** |
| | **25PMA3IT** | **Internship Training ****** | **Grade** | | | | | |
| | | **Total** | **30** | **-** | **-** | **500** | **-** | **22** |
| **IV** | 25PMA412 | Core Paper 12 Mathematical Methods | 8 | 25 | 75 | 100 | 3 | 6 |
| | 25PMA413 | Core Paper 13 Control Theory | 8 | 25 | 75 | 100 | 3 | 6 |
| | 25PMA414 | Core Paper 14 Programming in Python - Theory | 5 | 25 | 75 | 100 | 3 | 3 |
| | 25PMA4CM | Core Practical 2 Programming in Python - Practical | 2 | 40 | 60 | 100 | 3 | 2 |
| | **25PMA4E2** | **Major Elective 2** | **7** | 25 | 75 | **100** | **3** | **5** |
| | **25PMA4Z1** | **Project and Viva voce** | **-** | 20 | 80 | **100** | **-** | **2** |
| | | **Total** | **30** | **-** | **-** | **600** | **-** | **24** |
| **Grand Total** | | | | **-** | **-** | **2200** | **-** | **90** |

**Note :**

CBCS – Choice Based Credit system
CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

**Major Elective Papers**
**(2 papers are to be chosen from the following 6 papers)**

1. Fluid Dynamics
2. Graph Theory
3. Fundamentals of Actuarial Mathematics
4. Cryptography
5. Stochastic Process
6. Mathematical Modelling

**Non Major Elective Papers**
**(2 papers are to be chosen from the following 4 papers)**

1. System Analyses and Design
2. Information Security#
3. Fuzzy Logic and Neural networks
4. Measure and Integration

# to be offered by the respective departments.

**Sub. Code & Title of the Extra Departmental Course (EDC) :**

**25PMA3XL – EDC Paper 1 – Typesetting in LaTeX Techniques – Practical**

**ADVANCED LEARNER'S COURSE (SELF STUDY)**

| Subject Code | | Course | Title of the Paper | Instruction hours/cycle | CIA | ESE | TOTAL | Duration of the Exam | Credits |
|---|---|---|---|---|---|---|---|---|---|
| 25PMA0D1 | II | **ALC 1** | Discrete Mathematics and Automata Theory | - | - | 100 | 100 | 3 | 2 |
| 25PMA0D2 | Optional | **ALC 2** | Astronomy | - | - | 100 | 100 | 3 | 2 |
| 25PMA0D3 | | **ALC 3** | Internet and JAVA Programming | - | - | 100 | 100 | 3 | 2 |

**Diploma Course**

1. Diploma Course in Vedic Mathematics for both UG and PG students.
2. PG Diploma in Data Analytics.
3. PG Diploma in Operations Research.

**Certificate Course**

**1.** Certificate course in Vedic Mathematics for both UG and PG students.
2. Certificate course in Advanced Excel for both UG and PG students.

**Tally Table:**

| Subject | No. of Subjects | Total Marks | Credits |
|---|---|---|---|
| Core – Theory / Practical / Project | 17 | 1700 | 70 |
| Major Elective Papers | 2 | 200 | 10 |
| EDC Paper | 1 | 100 | 2 |
| Non Major Elective Papers | 2 | 200 | 8 |
| **Grand Total** | **22** | **2200** | **90** |

- 25 % CIA is applicable to all subjects except JOC, ALC and COP which are considered as extra credit courses.
- 100 % CIA for Information Security and EDC.
- The students should complete any **MOOC course available for Online learning platforms like SWAYAM, NPTEL, IIT Bombay Spoken Tutorial, e-Pathshala etc.,** with a minimum of 4 weeks in duration before the completion of the 3rd semester and the course completion certificate should be submitted through the HOD to the Controller of Examinations. Extra credits will be given to the candidates who have successfully completed.
- **Onsite Training** preferably relevant to the course may be undertaken as per the discretion of the faculty or HoD.

**Components of Continuous Internal Assessment**

| Components | | Marks | Total |
|---|---|---|---|
| **Theory** | | | |
| CIA I | 75 | (75+75 = 150/10) 15 | 25 |
| CIA II | 75 | | |
| Assignment/Seminar | | 5 | |
| Attendance | | 5 | |
| **Practical** | | | |
| CIA Practical | | 25 | 40 |
| Observation Notebook | | 10 | |
| Attendance | | 5 | |
| **Project** | | | |
| Review | | 15 | 20 |
| Regularity | | 5 | |

## BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

**K1**-Remembering; **K2**-Understanding; **K3**-Applying; **K4**-Analyzing; **K5**-Evaluating

1. **Theory Examination**

   **CIA I & II and ESE: 75 Marks**

| Knowledge Level | Section | Marks | Description | Total |
|---|---|---|---|---|
| K1 – K2<br>Q1 to 10 | A (Answer all) | 10 x 1 = 10 | MCQ | 75 |
| K2 – K4<br>Q11 to 15 | B (Either or pattern) | 5 x 5 = 25 | Short Answers | |
| K2 – K4<br>Q16 to 20 | C (Either or pattern) | 5 x 8 = 40 | Descriptive / Detailed | |

2. **Practical Examination:**

| Knowledge Level | Section | Marks | Total |
|---|---|---|---|
| K3 | Experiments | 50 | 60 |
| K4 | Record Work | 10 | |
| K5 | | | |

3. **Project Viva Voce:**

| Knowledge Level | Section | Marks | Total |
|---|---|---|---|
| K3 | Project Report | 60 | 80 |
| K4 | Viva voce | 20 | |
| K5 | | | |

25PMA101

| **Programme Code :** 02 | | M.Sc Mathematics | | |
|---|---|---|---|---|
| Title of the paper | | **Core Paper 1 –**ALGEBRA | | |
| **Batch** | **Hours / Week** | **Total Hours** | **Credits** | **Skill Development** |
| 2025-2027 | 7 | 105 | 5 | |

**Course Objectives**

1. To study groups, rings, fields and linear transformations which are widely used in many research fields and the concepts of mappings are applied in the subjects like analysisand topology.
2. To show the needs from which a modern mathematical attitude may grow and it is of great help in any further axiomatic study of mathematics.
3. To study the concept of linear transformations using matrices. Also, Contemporary mathematics and mathematical physics make extensive use of abstract algebra.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concept of rings, fields and extension fields. |
| | CO2 | Understanding the difference between algebraic and transcendental extensions; be able to find the minimal polynomial for algebraic elements over a field and be able to prove whether a polynomial is irreducible over a given field. |
| | CO3 | Applying Sylow's theorems to determine the structure of certain groups of small order and also Gauss lemma, Eisentein criterion for irreducibility of rationals. |
| | CO4 | Analyzing Galois groups in simple cases and to apply the group theoretic information to deduce results about fields and polynomials. |
| | CO5 | Evaluating linear transformation in Vector Space. |

**Syllabus**

**Unit I** **(21 Hours)**

Group Theory: Another Counting Principle – Conjugacy* – Normalizer – Cauchy's Theorem - Sylow's Theorem - Direct Products.

**Unit II** **(21 Hours)**

Ring Theory: **Euclidean Rings*** – Unique Factorization Theorem - A Particular Euclidean Ring – Fermat's Theorem - Polynomial Rings - Polynomials over the Rational Field - Gauss' Lemma - The Eisentein Criterion.

25PMA101

**Unit III** **(20 Hours)**

Fields: Extension fields - Algebraic Extension – Roots of polynomials – Remainder Theorem Splitting field.

**Unit IV** **(22 Hours)**

More about roots: Simple Extension. The Elements of Galois Theory – Fixed field of a Group - Normal Extension - The Galois group of a polynomial - Fundamental Theorem of Galois Theory.

**Unit V** **(21 Hours)**

Linear Transformations: Canonical Forms – Similar Transformation – Triangular Form – Trace and Transpose – Symmetric Matrix – Skew Symmetric Matrix - Hermitian, Unitary and Normal Transformations.

*** Self Study (Questions may be asked from these portions also)**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

I. N.Herstein, Topics in Algebra, 2nd Edition, Wiley Eastern Limited, 2017.

| | | |
|---|---|---|
| Unit I | Chapter 2 | Sections 2.11 to 2.13. |
| Unit II | Chapter 3 | Sections 3.7 to 3.10. |
| Unit III | Chapter 5 | Sections 5.1 and 5.3. |
| Unit IV | Chapter 5 | Sections 5.5 and 5.6. |
| Unit V | Chapter 6 | Sections 6.4, 6.8 and 6.10. |

**Reference Books**

1. John B.Fraleigh, A First Course in abstract Algebra , 3rd Edition, Narosa Publishing House, 1998.
2. P.B.Bhattacharya ,S.K.Jain and S.R.Nagpaul , Basic abstract Algebra, 2nd Edition, Cambridge University Press, 2004.

25PMA101

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | H | S | M |
| **CO2** | S | H | M | S | H |
| **CO3** | H | H | S | S | H |
| **CO4** | S | H | S | H | S |
| **CO5** | S | H | M | S | H |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA102

| **Programme Code :** 02 | | **M.Sc Mathematics** | | |
|---|---|---|---|---|
| **Title of the paper** | | **Core Paper 2 -** REAL ANALYSIS | | |
| **Batch** | **Hours / Week** | **Total Hours** | **Credits** | **Skill Development** |
| 2025-2027 | 6 | 90 | 4 | |

## Course Objectives

1. To learn about advanced topics in Riemann's Stieltjes Integrals.
2. To study the mean value theorem for Riemann and Riemann's Stieltjes integrals.
3. To study directional derivatives, total derivatives, Jacobian determinant and their applications.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the upper and lower integrals and the Riemann conditions. |
| | CO2 | Understanding the difference between necessary and sufficient conditions for Riemann's Stieltjes Integrals. |
| | CO3 | Identifying the sufficient conditions for differentiability and mixed partial derivatives. |
| | CO4 | Analyzing the Jacobian determinant to understand the Implicit and Inverse function theorems. |
| | CO5 | Evaluating the complex integration and Labesgue integral. |

## Syllabus

**UNIT I** **(18 Hours)**

The Riemann – Stieltjes Integral: Monotonically increasing integrators. **Upper andlower integrals*** –Additive and Linearity properties of upper and lower integrals –Riemann's condition – Comparison theorems –Integrators of bounded variation.

**UNIT II** **(18 Hours)**

Sufficient conditions for existence of Riemann - Steiltjes integrals - Necessary conditions for existence of Riemann- Steiltjes integrals –Mean value theorems for R S integrals - The integrals as a function of the interval – Second fundamental theorem of integral calculus – Change of variable in a Riemann integral – Second Mean value theorem for Riemann integral.

25PMA102

**UNIT III** **(18 Hours)**

Multivariable Differential Calculus - Introduction –The directional derivative - Directional derivatives and continuity –The total derivative – The total derivative expressed in terms of partial derivatives – The matrix of a linear function **- The Jacobian Matrix* -** The chain rule.

**UNIT IV** **(18 Hours)**

The Mean value Theorem for differentiable functions - A sufficient condition for differentiability – A sufficient condition for equality of mixed partial derivatives – Taylor's formula for functions from $R^n$ to $R^1$.

**UNIT V** **(18 Hours)**

Implicit Functions and Extremum Problems: Introduction - Functions with nonzero Jacobian determinant – The inverse function theorem – The implicit function theorem.

*** Self Study (Questions may be asked from these portions also)**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**TEXT BOOK**

1. Tom M.Apostol, Mathematical Analysis, Addition –Wesley, 2002.

| | | |
|---|---|---|
| Unit I | Chapter 7 | Sections 7.11 to 7.15 |
| Unit II | Chapter 7 | Sections 7.16 to 7.22 |
| Unit III | Chapter 12 | Sections 12.1 to 12.5 , 12.7 to 12.9 |
| Unit IV | Chapter 12 | Sections 12.11 to 12.14 |
| Unit V | Chapter 13 | Sections 13.1 to 13.4 |

**REFERENCE BOOKS**

1. J.V.Deshpande, Mathematical Analysis and applications – An introduction, Narosa Publishing house, New Delhi, 2004.
2. Shanthi Narayan, A course of Mathematical Analysis ,S.Chand and company,1st Edition, New Delhi, 1996.
3. W.Rudin, Real and Complex Analysis, McGraw- Hill company, 3rd Edition, New York, 1986.
4. D.Somasundaram and B.Chaudhary, A first course in Mathematical Analysis , Narosa Publishing house, New Delhi, 1999.

25PMA102

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | S | M | S |
| **CO2** | S | H | M | S | H |
| **CO3** | H | M | S | S | S |
| **CO4** | S | S | H | M | H |
| **CO5** | S | M | H | S | H |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA103

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| Title of the Paper | | Core Paper 3 - Ordinary Differential Equations | | |
| **Batch** 2025-2027 | **Hours / Week** 7 | **Total Hours** 105 | **Credits** 5 | Skill Development |

**Course Objectives**

1. To understand the concepts of fundamental matrix and successive approximation for finding solution.
2. To enable the students to know the concepts of non-homogeneous linear systems with constant co-efficient and periodic co-efficient.
3. To gain knowledge in the area of linear oscillations and non-linear oscillations.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the different types of differential equations. |
| | CO2 | Understanding the concept of linear oscillations and non-linear oscillations. |
| | CO3 | Applying the notions of fundamental matrix and successive approximations in the system of differential equations. |
| | CO4 | Analyzing the non-homogeneous linear systems with constant co-efficient and periodic co-efficient. |
| | CO5 | Evaluating the solutions for homogeneous systems with linear and non-linear oscillations |

**Syllabus**

**UNIT I** **(21 Hours)**

Systems of first order equations – Existence and uniqueness theorem - Fundamental matrix.

**UNIT II** **(21 Hours)**

Non –homogeneous linear systems –Linear systems with constant coefficients – Linear systems with periodic coefficients.

**UNIT III** **(21 Hours)**

Second order linear equations with ordinary points –Legendre equation and Legendre polynomials -Second order equations with regular singular points –Bessel equation.

**UNIT IV** **(21 Hours)**

Successive approximations –Picard's theorem –Some Examples–Continuation and dependence on initial conditions -**Existence of solutions in the large*** -Existence and uniqueness of solutions of systems.

**UNIT V** **(21 Hours)**

Fundamental results –Strum's comparison theorem –**Elementary linear Oscillations*** - Comparison theorem of Hille-Wintner Oscillations of $x'' + a(t)x = 0$ .

25PMA103

*** denotes self study**

**Questions for examinations may be taken from the self study portions also.**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**TEXT BOOK**

S.G.Deo, V. Raghavendra, RasmitaKar and V. Lakshmikantham, Ordinary Differential Equations, 3rd Edition, Tata McGrew - Hill Publishing Company Ltd, New Delhi, 2018.

| | | |
|---|---|---|
| Unit I | Chapter 5 | Sections 5.2, 5.4, 5.5 |
| Unit II | Chapter 5 | Sections 5.6 to 5.8 |
| Unit III | Chapter 6 | Sections 6.2 to 6.5 |
| Unit IV | Chapter 2 | Sections 2.3 to2.8 |
| Unit V | Chapter 7 | Sections 7.1 to 7.5 |

**REFERENCE BOOKS**


1. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, 2nd Edition, Tata McGraw Hill Pvt. Ltd, New Delhi, 2002.
2. V.I. Arnold, Ordinary Differential Equation, Prentice Hall of India Pvt. Ltd, New Delhi, 1998.
3. E.L. Ince, Ordinary Differential Equations, Dover Publications, INC, New York, 1956.
4. Coddington, Theory of Ordinary Differential Equations, S. Chand Pvt., Ltd, 2000.


**Mapping**

| PSO<br>CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | S | S | H |
| **CO2** | H | H | S | M | S |
| **CO3** | H | S | H | H | H |
| **CO4** | S | S | M | H | S |
| **CO5** | H | S | M | S | H |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA104

| **Programme Code :**02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | **Core paper 4 -** NUMERICAL ANALYSIS | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>6 | **Total Hours**<br>90 | **Credits**<br>4 | **Skill Development** |

## Course Objectives

1.To solve the linear equations, non-linear equations and interpolating the values using numerical methods.
2.To obtain the solution of Boundary Value Problems and Characteristic Value Problems Using Numerical Methods.
3.To find the Solution of Ordinary Differential Equations and Partial Differential Equations Using Numerical methods.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering various numerical methods for finding the solution of algebraic and transcendental equations. |
| | CO2 | Demonstrating various numerical algorithms for solving simultaneous linear algebraic equations. |
| | CO3 | Applying various numerical methods to solve differential equations. |
| | CO4 | Analyzing the Boundary Value Problems and Characteristic Value Problems. |
| | CO5 | Evaluating the Characteristic values using power method |

## Syllabus

**UNIT I** **(18 Hours)**

Solution of Nonlinear Equations- Newton's method- Convergence of Newton's method – Secant Method – Muller method - Chebyshev method - Birge – Vieta method - Bairstow's method - Graeffe's root squaring method

**UNIT II** **(18 Hours)**

Numerical Differentiation: Derivatives from difference tables – Higher order derivatives: Newton's forward, Newton's backward, Bessel's, Stirlings and Divided difference formula for derivatives. Numerical Integration: Trepezoidal - Simpson's rules - Romberg integration.

25PMA104

**UNIT III** **(18 Hours)**

Solution of Ordinary Differential Equations - Taylor series method – Euler and Modified Euler methods - Runge –Kutta methods – Multistep methods – Milne's method – Adams Moulton method.

**UNIT IV** **(18 Hours)**

Boundary Value Problems and Characteristic Value Problems: Solution through a set of equations – Derivative boundary conditions – Characteristic value problems – **Eigen values of a matrix*** by iteration – The power method.

**UNIT V** **(18 Hours)**

Numerical Solution of Partial Differential Equations - Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations : Representation as a difference equation – Laplace's equation on a rectangular region – Iterative methods for Laplace equation – The Poission equation – Derivative Boundary conditions – Solving the equation for time – dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – Solving the wave equation by finite differences.

***denotes Self Study (Questions for examinations may be taken from this Portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

1. M.K. Jain, S.R.K.Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computation, John Wiley and Sons, New Age International (p) Limited Publishers, New Delhi, 6th Edition, 2012. (For Unit I)

Unit I Chapter 2 Section 2.3, 2.4.1, 2.4.2, 2.7

3. C.F.Gerald and P.O.Wheatley, Applied Numerical Analysis, 5th Edition, Addition Wesley, 1998. (For Units II-V)

Unit II Chapter 3 Section 3.3
Chapter 4 Sections 4.2, 4.3, 4.7

| | | |
|---|---|---|
| Unit III | Chapter 5 | Sections 5.2 to 5.7 |
| Unit IV | Chapter 6 | Sections 6.2 to 6.3, 6.6,6.7 |
| Unit V | Chapter 7 | Sections 7.3 to 7.7 |
| | Chapter 8 | Sections 8.1 to 8.3 |
| | Chapter 9 | Section 9.2 |

**Reference Books**

1. S.C.Chapra and P.C.Raymond, Numerical Methods for Engineers, Tata McGraw Hill, New Delhi 2000.
2. R.L.Burden and J.DouglasFaries, Numerical Analysis, 4th Edition, PWS Kent Publishing Company, Boston 1989.
3. S.S.Sastry, Introductory methods of Numerical Analysis, Prentice-Hall of India, New Delhi, 1998.
4. P.Kandasamy et al. Numerical Methods, S.Chand& Co., Ltd., New Delhi 2003.

**Mapping**

| PO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | H | S | S | M | S |
| **CO2** | S | M | M | S | H |
| **CO3** | H | M | S | H | S |
| **CO4** | S | S | H | S | H |
| **CO5** | S | H | S | H | S |

S-Strong ; H-High; M-Medium ; L-Low

25PMA205

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | **Core Paper 5 -** COMPLEX ANALYSIS | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>7 | **Total Hours**<br>105 | **Credits**<br>4 | **Skill Development** |

**Course Objectives**

1. To study Cauchy's theorem and applying it for a rectangle and a disk.
2. To know various types of singularities and evaluation of definite integrals using residues.
3. To understand the concept of power series expansions and canonical products.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Recalling rectifiable arcs and line integrals as functions of arcs. |
| | CO2 | Explaining the concepts of Local mapping theorem, Cauchy residue theorem and its applications. |
| | CO3 | Applying the Residue theorem on definite integrals. |
| | CO4 | Analyzing the concepts of Weirstras's theorem and Taylor series. |
| | CO5 | Determining the genus of an Entire function. |

**SYLLABUS**

**UNIT I** **(22 Hours)**

*****Fundamental Theorems: Line Integrals – **Rectifiable Arcs - Line Integrals as Functions of Arcs*** – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk - Cauchy's Integral formula: The index of a point with respect to a closed curve – The Integral formula – Higher derivatives.

**UNIT II** **(20 Hours)**

Local Properties of Analytic Functions: Removable Singularities - Taylor's theorem – Zeros and poles – The Local Mapping – The Maximum principle.

25PMA205

**UNIT III** **(21 Hours)**

The Calculus of Residues: The Residue theorem – The Argument Principle – Evaluation of Definite Integrals - Harmonic functions: Definitions and Basic Properties – The Mean - value Property – Poisson's formula – Schwarz's Theorem.

**UNIT IV** **(21 Hours)**

Power Series Expansions: Weierstrass's Theorem – The Taylor Series – The Laurent Series - Partial fractions and Factorization: Partial Fractions – Infinite Products.

**UNIT V** **(21 Hours)**

Canonical Products – The Riemann Mapping theorem : Statement and Proof - The Schwarz – Christoffel Formula – A closer look at harmonic functions: Functions with Mean - value Property - Harnack's Principle.

***denotes Self Study (Questions for examinations may be taken from this Portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**TEXT BOOK**

1.L.V.Ahlfors, Complex Analysis, McGraw Hill Education (India) Pvt. Ltd, 2013.

| | | |
|---|---|---|
| Unit I | Chapter 4 | Sections 1.1 – 1.5 |
| | Chapter 4 | Sections 2.1 – 2.3. |
| Unit II | Chapter 4 | Sections 3.1 – 3.4 |
| Unit III | Chapter 4 | Sections 5.1 – 5.3, 6.1 – 6.4 |
| Unit IV | Chapter 5 | Sections 1.1 – 1.3, 2.1 , 2.2 |
| Unit V | Chapter 5 | Section 2.3 |
| | Chapter 6 | Sections 1.1, 2.2, 3.1, 3.2. |

25PMA205

**REFERENCE BOOKS**

1. Walter Rudin, Real and Complex Analysis, Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2006.
2. John B.Conway, Functions of one Complex Variable , 2nd Edition, Narosa Publishing House, New Delhi, 2002.
3. S.Ponnusamy, Foundations of Complex Analysis, 2nd Edition, Narosa Publishing House, New Delhi, 2010.

**MAPPING**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | S | M | S |
| **CO2** | S | H | M | S | H |
| **CO3** | H | M | S | S | S |
| **CO4** | S | S | H | M | H |
| **CO5** | S | H | M | S | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA206

| **Programme Code :** 02 | | **M.Sc Mathematics** | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 6 - Partial Differential Equations | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>6 | **Total Hours**<br>90 | **Credits**<br>4 | **Skill Development** |

## Course Objectives

1. To study linear partial differential equations and non-linear partial differential equations.
2. To know the concept of partial differential equations and their role in modern mathematics.
3. To understand the concepts of wave equations and diffusion equations.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Finding the solutions of nonlinear partial differential equations by using Charpit's and Jocobi methods |
| | CO2 | Understanding the classification of PDE's and interpret the solutions using analytical methods. |
| | CO3 | Applying the method of separation of variables and the method of integral transforms to solve the initial, boundary value problems. |
| | CO4 | Analyzing the solutions of Laplace equations subject to the boundary conditions. |
| | CO5 | Evaluating the elementary solutions of wave equations, diffusion equations using calculus of variations. |

## Syllabus

**Unit I** **(18 Hours)**

Non-linear partial differential equations of the first order compatible systems of first order equations- Charpit's Method - **Special types of first order equations*** and Jacobi's Method.

**Unit II** **(18 Hours)**

Linear partial differential equations with constant co-efficient and Equations with variable Co-efficients.

**Unit III** **(18 Hours)**

Method of separation of variables and the Method of Integral Transforms.

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**Unit IV** **(18 Hours)**

Elementary solutions of Laplace equations- Families of equi-potential surface-Boundary value problems –Separation of Variables and problems with axial symmetry.

**Unit V** **(18 Hours)**

Elementary solutions of one dimensional wave equations – Vibrating Membranes: Applications of Calculus of variations – Elementary solutions of Diffusion equations and Separation of variables.

*** Self Study (Questions may be asked from these portions also)**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

Ian N. Sneddon, Elements of Partial Differential Equations, Dover Publications, INC-New York, 2006.

| | | |
|---|---|---|
| Unit I | Chapter 2 | Sections 7, 9 – 11, 13 |
| Unit II | Chapter 3 | Sections 4, 5 |
| Unit III | Chapter 3 | Sections 9, 10 |
| Unit IV | Chapter 4 | Sections 2 - 6 |
| Unit V | Chapter 5 | Sections 2, 4 |
| | Chapter 6 | Sections 3, 4 |

**Reference Books**

1. Michael Renardy and Robert C. Rogers, An Introduction to Partial Differential Equations, Second Edition, Springer, 2004.
2. Robert C. Mc Owen, Partial Differential Equations, Methods and Applications, Second Edition, Pearson Education, Inc., 2004.
3. T.Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, New Delhi, Reprint 2004.

4. TynMyint.U, Loknath and Debnath, Linear Partial Differential Equations for Scientists and Engineers, Brikhauser Boston, Fourth edition, 2006.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | S | M | H | H |
| **CO2** | H | S | H | M | H |
| **CO3** | M | S | H | S | H |
| **CO4** | S | H | H | S | H |
| **CO5** | S | H | H | M | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA207

| **ProgrammeCode :**02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 7-MECHANICS | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>6 | **Total Hours**<br>90 | **Credits**<br>4 | **Skill Development** |

**Course Objectives**

1. To know the basic concepts of the Mechanical system.
2. To understand about the constraints, differential forms and Generating functions
3.To acquire knowledge about mechanical concepts to solve various problems in Mechanics.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concepts of generalized co-ordinates and constraints. |
| | CO2 | Explaining the derivation of Lagrange's and Hamilton equations. |
| | CO3 | Applying Hamilton Principle for deriving Hamilton Jacobi Equation. |
| | CO4 | Analyzing the Lagrange's and Poisson Brackets. |
| | CO5 | Evaluating the transformation equations using generating functions |

**SYLLABUS**

**UNIT I** **(18 hours)**

Introductory concepts: Mechanical Systems –Generalized Co-ordinates – Constraints -Virtual work.

**UNIT II** **(18 hours)**

Lagrange's Equations: Derivation of LaGrange's Equations –**Examples*** –Integrals of motion.

**UNIT III** **(18 hours)**

Hamilton's Equations: Hamilton's Principle – Hamilton's equations.

**UNIT IV** **(18 hours)**

Hamilton –Jacobi Theory: Hamilton's Principle function –Hamilton –Jacobi equation – **Separability*.**

**UNIT V** **(18 hours)**

Canonical Transformations: Differential forms and Generating functions –Lagrange and Poisson Brackets.

*** Self Study (Questions may be asked from these portions also)**

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**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

D.T.Greenwood, Classical Dynamics, Prentice Hall of India pvt. ltd., New Delhi, 1979.

| | | |
|---|---|---|
| Unit I | Chapter 1 | 1.1 – 1.4 |
| Unit II | Chapter 2 | 2.1 – 2.3 |
| Unit III | Chapter 4 | 4.1 – 4.2 |
| Unit IV | Chapter 5 | 5.1 – 5.3 |
| Unit V | Chapter 6 | 6.1 and 6.3 |

**Reference Books**


1. John.L. Synge and Byron.A. Griffth, Principles of Mechanics, 3rd Edition, Mcgrow Hill Kogakygha Ltd, 1970.
2. Goldstin, Classical Mechanics, Prentice Hall of India , New Delhi, 1979.
3. SankaraRao.K, Classical Mechanics, K.K. Publications Prentice Hall of India and the Parkar, 2005.


**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | M | H | S | M |
| **CO2** | M | H | S | M | H |
| **CO3** | S | M | M | H | S |
| **CO4** | H | S | M | H | M |
| **CO5** | S | H | S | M | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA208

| **Programme Code:**02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 8 OBJECT ORIENTED PROGRAMMING WITH C++ - THEORY | | |
| **Batch** 2025-2027 | **Hours / Week** 5 | **Total Hours** 75 | **Credits** 4 | **Skill Development** |

**Course Objectives**

1. To enable the students to learn about the basic concepts of Object Oriented Programming Techniques, class structure, operators, functions in C++ and operators Overloading and Type Conversions.
2. To know the differences between object oriented programming and procedure oriented programming.
3. To apply object oriented techniques to solve the computing Problems.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Finding solutions for problems in Mathematics, Engineering, Science and Technology using Object Oriented Programming. |
| | CO2 | Classifying secured and unsecured data processing by applying Abstraction, Encapsulation and Information hiding. |
| | CO3 | Constructing programmes using C++ features such as composition of objects, Inheritance and Polymorphism. |
| | CO4 | Analyzing the concepts of Object Oriented Programming to solve real world problems. |
| | CO5 | Evaluating the solutions of Mathematical problems using C++ Programs. |

**Syllabus**

**UNIT I** **(15 Hours)**

**Principles of Object- Oriented Programming**

Software crisis – Software evolution – A look at procedure-oriented programming – Object oriented programming paradigm – Basic concept of Object -oriented programming – Benefits of OOP – Object Oriented Languages – **Applications of OOP *.**

**UNIT II** **(15 Hours)**

**Tokens, Expressions and Control Structures**

Introduction – **Tokens – Keywords*** – Identifiers and constants – Basic data types – User Defined data types – Derived data types – Symbolic constants – Type compatibility – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ - Scope resolution operator – Member Dereferencing operators - Memory management

operators – Manipulators – Type cast operator – Expressions and their Types – Special assignment expressions – Implicit conversions – Operator overloading – Operator precedence – Control structures.

**UNIT III** **(15 Hours)**

**Functions in C++**

Introduction – The main function – Function prototyping – Call by reference – Return by reference- Inline functions – Default arguments – Constant arguments – Function overloading – Friend and virtual functions – Math Library functions. **Managing Console I/O operations** Introduction – C++ streams - C++ stream classes – Unformatted I/O operations – Formatted Console I/O operations – Managing Output with Manipulators.

**UNIT IV** **(15 Hours)**

**Classes and Objects**

Introduction – C structures revisited – Specifying a class – Defining member functions – A C++ program with class – Making an outside function inline – Nesting of member functions – Private member functions – Arrays within a class – Memory allocation for objects – Static data members – Staticmember functions – Arrays of objects – Objects as function arguments – Friendly functions – Returning objects – Constant member functions.

**Constructors and Destructors**

Introduction – Constructors – Parameterized Constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initializations of objects – Copy constructor – Constructing two- dimensional arrays – Constant objects – Destructors.

**UNIT V** **(15 Hours)**

**Operators Overloading and Type Conversions**

Introductions – Defining operator overloading – Overloading unary operators – Overloading Binary operators – Overloading Binary operators using friends – Manipulation of strings using operators – Rules of overloading operators.

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**Inheritance: Extending Classes**

Introduction – Defining Derived Classes – Single inheritance – Making a Private member inheritable – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes – Nesting of Classes.

***denotes Self study (Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

E.Balaguruswamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing Company Ltd, 1999.

| | |
|---|---|
| Unit I | Sections 1.1 to 1.8 |
| Unit II | Sections 3.1 to 3.24 |
| Unit III | Sections 4.1 to 4.11 & 10.1 to 10.6 |
| Unit IV | Sections 5.1 to 5.17 & 6.1 to 6.7, 6.9 to 6.11 |
| Unit V | Sections 7.1 to 7.7 & 8.1 to 8.12 |

**Reference Books**

1.AshokN.Kamthane, Object Oriented Programming with ANSI and TURBO C++, Pearson Education (P) Ltd, 2003.

2. BjarmeStroustrup, The C++ Programming Language, AT & T Labs, Murray Hill, New Jersey, 1998.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | S | H | S |
| **CO2** | H | S | H | M | H |
| **CO3** | S | H | S | S | S |
| **CO4** | M | S | M | H | M |
| **CO5** | S | M | H | S | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA2CL

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Practical 1 OBJECT ORIENTED PROGRAMMING WITH C++ - PRACTICAL | | |
| **Batch** 2025-2027 | **Hours / Week** 2 | **Total Hours** 30 | **Credits** 2 | **Skill Development** |

**Course Objectives**

1. To identify and formulate the techniques of software development using Object Oriented Programming concepts.
2. To find the solution of complex problems spanning the breadth of the C++ Programming language.
3. To write programs for problems in various domains like Mathematics, Science, Technology and real world problems.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K3 to K5 | CO1 | Remembering the syntax to write a program |
| | CO2 | Understanding the concepts of object oriented programming. |
| | CO3 | Applying the concepts of Object Oriented Program for building object based applications. |
| | CO4 | Analyzing different logic with suitable validations for a given problem. |
| | CO5 | Interpret and design the Exception Handling Techniques for resolving run-time errors using file I/O. |

**LIST OF PRACTICAL**

**OBJECT AND CLASSES**

1. Create a class ARITH which consists of a FLOAT and an INTEGER variable. Write member functions ADD ( ), SUB ( ) , MUL ( ) , DIV ( ), MOD ( ) to perform addition, subtraction , multiplication, division and modulus respectively. Write member functions to get and display values.

2. Create a class metre with member functions take ( ) and show ( ) to convert metres into kilometres and centimetres and show the results.

**(5 Hours)**

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**CONTROL STRUCTURES**

3.Write a program to evaluate the following function to 0.00001% accuracy

(i) $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$

(ii) $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots$

4. Write a program to calculate the variance and standard deviation of N numbers. **(4 Hours)**

**CONSTRUCTORS AND DESTRUCTORS**

5. Create a class complex with float variables. Add two complex values using overloaded constructors. **(4 Hours)**

**OPERATOR OVERLOADING**

6. Create a class MAT has a 2 D matrix and R& C represent the rows and columns of the matrix. Overload the operators + , - , * to add , subtract and multiply two matrices. Write member functions to get and display MAT object values.
7. Create a class STRING. Write member functions to initialize, get and display strings. Overload the operator + to concatenate two strings , = = to compare 2 strings and a member functions to find the length of the string. **(6 Hours)**

**INHERITANCE**

8. Create a class which consists of EMPLOYEE detail like eno ,ename, dept, basic salary, grade. Write member functions to get and display them. Derive the class PAY from the above class and write a member function to calculate da, hra, pf, depending on the grade and display the Payslip in a neat format using console I/ O.
9. Create a class SHAPE which consists of two VIRTUAL FUNCTIONS Cal _ Area ( ) and Cal Peri to calculate Area and perimeter of various figures. Derive three classes SQUARE, RECTANGLE and TRIANGLE from the class SHAPE and calculate Area and perimeter of each class separately and display the results*.
10. Create two classes which consists of two private variables, one integer and one float variable in each class. Write member functions to get and display them. Write a FRIEND function common to arguments and the integer and float values of both the objects separately and display the results. **(7 Hours)**

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**CONSOLE I / O**

11. Write a user defined function USERFUN ( ) which has the formatting commands like setw ( ), showpoint , showpos, precision ( ) . Write a program which prints a multiplication table and uses USERFUN ( ) for formatting.
12. Write a program to read the name, number, meter reading, consumed units and print out the same and the total bill amount* . **(4 Hours)**

| **Distribution of Marks in ESE** | | | **CIA** | | |
|---|---|---|---|---|---|
| Experiment | : | 50 | CIA Practical | : | 25 |
| Record | : | 10 | Exam | | |
| **Total** | | **60** | Attendance | : | 5 |
| | | | Observation Note book | : | 10 |
| | | | **Total** | | **40** |

To be awarded jointly by the internal and external examiners

**Mapping**

| **PSO CO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
|---|---|---|---|---|---|
| **CO1** | H | H | S | M | S |
| **CO2** | H | S | H | S | M |
| **CO3** | M | S | M | M | S |
| **CO4** | S | H | S | M | S |
| **CO5** | H | S | H | S | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA309

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 9 TOPOLOGY | | |
| **Batch** 2025-2027 | **Hours / Week** 7 | **Total Hours** 105 | **Credits** 5 | **Skill Development** |

**Course Objectives**

1. To get basic knowledge in topology and topological spaces.
2. To study the concepts of Compactness and Connectedness.
3. To know the concept of countability axioms.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Knowing the basic definitions and properties in topology. |
| | CO2 | Classifying the ideas of product topology and metric topology. |
| | CO3 | Applying countability and separation axioms in proving Urysohn lemma and Urysohn Metrization theorem. |
| | CO4 | Analyzing the concepts of limit point compactness and local compactness. |
| | CO5 | Deducing the properties of Regular, Normal and Hausdorff spaces. |

**Syllabus**

**UNIT I** **(18 Hours)**

Topological Spaces – **Basis for a topology*** – The order topology – The product topology on X x Y – Closed sets and Limit Points.

**UNIT II** **(18 Hours)**

Continuous functions - The product topology –The metric topology.

**UNIT III** **(24 Hours)**

**Connected spaces*** – Connected subspaces of the real line – Components and Local Connectedness.

**UNIT IV** **(24 Hours)**

Compact Spaces – Compact subspaces of the real line - Limit Point Compactness- Local compactness.

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**UNIT V** **(21 Hours)**

The countability axioms – The separation axioms –The Urysohn Lemma – Urysohn Metrization Theorem.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

James R.Munkers, Topology, Second Edition , Prentice Hall of India Pvt. Ltd., New Delhi,2011.

| | | |
|---|---|---|
| Unit I | Chapter 2 | Sections 12 to 15, 17 |
| Unit II | Chapter 2 | Sections 18, 19, 20 |
| Unit III | Chapter 3 | Sections 23,24,25 |
| Unit IV | Chapter 3 | Sections 26,27,28,29 |
| Unit V | Chapter 4 | Sections 30,31,33,34 |

**Reference Books**

1. J.Dugundji, Allyn and Bacon, Topology, Prentice Hall of India Pvt. Ltd, New Delhi 1966.
2. George F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Company, 1963.
3. Sze-Tsen Hu, Elements of General Topology, Holden – Day, Inc. 1965.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | H | H | H | H | M |
| **CO2** | S | M | S | M | H |
| **CO3** | M | S | H | H | H |
| **CO4** | H | S | S | S | S |
| **CO5** | S | M | H | S | H |

**S -** Strong; **H**-High; **M**-Medium; **L**-Low

25PMA310

| **ProgrammeCode :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 10 FUNCTIONAL ANALYSIS | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>7 | **Total Hours**<br>105 | **Credits**<br>5 | **Skill Development** |

## Course Objectives

1. To know the concepts of Normed linear spaces, Banach spaces and Hilbert spaces.

2. To understand the ideas of Uniform boundedness principles, closed graph theorem and Open mapping theorem.

3. To comprehend the notions of spectral radius, the spectral theorem and Operators on Hilbert spaces.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concepts of semi norms and Quotient spaces. |
| | CO2 | Understanding the operators on normed linear spaces. |
| | CO3 | Applying Uniform boundedness principle on bounded operators. |
| | CO4 | Analyzing the concepts of eigenspectrum on normed linear spaces and spectral radius on Banach spaces. |
| | CO5 | Evaluating the results of Adjoint, Self-Adjoint, Normal and Unitary Operators defined on Hilbert spaces. |

## Syllabus

**UNIT I** **(21 Hours)**

Normed Linear spaces: Norm on a Linear Space – Examples of Normed Linear Spaces(Cauchy-Schwarz inequality in $K^n$, Holder's inequality in $\mathcal{F}(\mathcal{N},\mathcal{K})$, Minkowski's inequality in $\mathcal{F}(\mathcal{N},\mathcal{K})$only). **Semi norms and Quotient Spaces*–** Product Space and Graph Norm – Inner product spaces – Banach Spaces.

**UNIT II** **(21 Hours)**

Operators on Normed Linear Spaces : Bounded operators – Some basic results and Examples(excluding Fredholm integral operator, Lagrange interpolatory projection) – Norm on $\mathcal{B}(\mathcal{X},\mathcal{Y})$(Definitions only)- Riesz representation theorem. More about Hilbert Spaces : Orthonormal Sets and Orthonormal Bases – Bessel's Inequality. Hahn Banach Theorem and its Consequences : The Extension Theorem.

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**UNIT III** **(21 Hours)**

Uniform BoundednessPrinciple : The Theorem and its Consequences –Closed Graph theorem and its Consequences: ` Closed Graph theorem – Bounded Inverse Theorem – Open Mapping Theorem.

**UNIT IV** **(21 Hours)**

Spectral Results for Banach Space Operators : Eigen spectrum and Approximate Eigen spectrum (Definitions and theorem statement only) – Spectrum and Resolvent set – Spectral Radius - Spectral Mapping Theorem.

**UNIT V** **(21 Hours)**

Operators on Hilbert Spaces : Adjoint of an Operator(Definitions and theorem statements only) – Compactness of the Adjoint Operator – Sesqilinear Functionals - Self-Adjoint, Normal and Unitary Operators – Numerical range and Numerical Radius – Some Characterizations.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

M. Thamban Nair, Functional Analysis – A First Course, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.

| | | |
|---|---|---|
| Unit I | Chapter 2 | Sections 2.1, 2.1.1, 2.1.2, 2.1.4, 2.1.5. |
| | | Sections 2.2, |
| Unit II | Chapter 3 | Section 3.1, 3.1.1, 3.3. |
| | Chapter 4 | Sections 4.1, 4.2. |
| | Chapter 5 | Section 5.1. |
| Unit III | Chapter 6 | Section 6.1. |
| | Chapter 7 | Sections 7.1, 7.2, 7.3. |
| Unit IV | Chapter 10 | Sections 10.1, 10.2, 10.2.1, 10.2.2. |
| Unit V | Chapter 11 | Sections 11.1, 11.1.1, 11.1.2. |
| | | Sections 11.2, 11.2.1, 11.2.2. |

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**Reference Books**

1. C.Goffman and G.Pedrick, A First Course in Functional Analysis, Prentice Hill of India, New Delhi, 1987.
2. G.Bachman and L.Narici, Functional Analysis, Academic Press, New York 1966.
3. L.A.Lustenik and V.J.Sobolev, Elements of Functional Analysis, Hindustan Publishing Corporation, New Delhi, 1971.
4. A.E.Taylor, Introduction to Functional Analysis, John Wiley & Sons, New York, 1958.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | **S** | **S** | **S** | **S** | **S** |
| **CO2** | **S** | **S** | S | **S** | **S** |
| **CO3** | **S** | **S** | H | **S** | **S** |
| **CO4** | **S** | **S** | S | **S** | **S** |
| **CO5** | **S** | **H** | S | **S** | **H** |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA311

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 11 MATHEMATICAL STATISTICS | | |
| **Batch** 2025-2027 | **Hours / Week** 7 | **Total Hours** 105 | **Credits** 5 | **Skill Development** |

**Course Objectives**

1. To study the concepts of random variables and different types of distributions.
2. To determine the moments of the distribution function by using the characteristic functions.
3. To understand the Methods of finding estimates, Sample moments and their functions

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K4 | CO1 | Remembering the random events and random variables of different distributions. |
| | CO2 | Classifying the properties of characteristic functions of various distributions. |
| | CO3 | Identifying the types of estimates for various probability distribution functions. |
| | CO4 | Analyzing the functions by using various significance tests. |
| | CO5 | Evaluating Characteristic function and moments of various distributions. |

**Syllabus**

**UNIT I** **(21 Hours)**

Random Events: Preliminary remarks – **random events and operations performed on them*** – the system of axioms of the theory of probability – conditional probability – Bayes theorem – Independent Events – Random variables : the concept of a random variable – the distribution function – Random variables of the discrete type and the continuous type – functions of random variables – Multidimensional random variables – Marginal distributions – conditional distributions – Independent random variables – Parameters of the distribution of a random variable - Expected values – Moments – The Chebyshev inequality – Absolute moments.

**UNIT II** **(21 Hours)**

Characteristic functions : **Properties of characteristic functions*** – The characteristic function and moments – Semi - Invariants – The characteristic function of the sum of independent random variables – Determination of the distribution function by the characteristic

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function – The characteristic function of multidimensional random vectors – Probability generating functions.

Some probability distributions : One point and two point distributions – The Bernoulli scheme: The binomial distribution – The Poisson distribution.

**UNIT III** **(21 Hours)**

Some probability distributions – The uniform distribution – The normal distribution – the gamma distribution – The beta distribution – The Cauchy and Laplace distributions – Limit theorems : Preliminary remarks – Stochastic convergence – Bernoulli's law of large numbers – The convergence of a sequence of distribution functions – The Levy - Cramer theorem –The de Moivre Laplace theorem – The Lindeberg – Levy theorem.

**UNIT IV** **(21 Hours)**

The theory of Estimation: Preliminary notions – Consistent estimates – Unbiased estimates – The sufficiency of an estimate – The efficiency of an estimate – Asymptotically most efficient estimates – Methods of finding estimates (Method of moments and the method of maximum likelihood estimates only).

**UNIT V** **(21 Hours)**

Sample moments and their functions : The notion of a sample – The notion of a statistic – The distribution of the arithmetic mean of independent normally distributed random variables – The $\chi^2$ distribution – Student's t- Distribution – Fisher's Z-distribution – Significance tests: The concept of a statistical test – Parametric tests for small samples – The $\chi^2$ test – Independence tests by contingency tables.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

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**Text Book**

MarekFisz, Probability theory and Mathematical Statistics, John Wiley & Sons, Inc, USA, 1980.

| | | |
|---|---|---|
| Unit I | Chapter 1 | 1.1 to 1.3, 1.5 to 1.7 |
| | Chapter 2 | 2.1 to 2.8 |
| | Chapter 3 | 3.1 to 3.4 |
| Unit II | Chapter 4 | 4.1 to 4.7 |
| | Chapter 5 | 5.1, 5.2 and 5.5 |
| Unit III | Chapter 5 | 5.6 to 5.10 |
| | Chapter 6 | 6.1 to 6.4, 6.6 to 6.8 |
| Unit IV | Chapter 13 | 13.1 to 13.7 |
| Unit V | Chapter 9 | 9.1 to 9.4, 9.6 and 9.7 |
| | Chapter 12 | 12.1, 12.2, 12.4 and 12.7 |

**References**

1. Sheldon M. Ross, Introduction to Probability Models , 8th Edition , Academic Press, USA, 2006.
2. S.K.Gupta and V.K.Kapoor , Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 2006.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | H | S | M |
| **CO2** | H | H | S | M | H |
| **CO3** | M | S | H | H | H |
| **CO4** | H | H | H | S | S |
| **CO5** | H | S | S | H | H |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA412

| **ProgrammeCode :**02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 12 MATHEMATICAL METHODS | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>8 | **Total Hours**<br>120 | **Credits**<br>6 | **Skill Development** |

**Course Objectives**

1. To study the concept of Fourier transforms .
2. To impart analytical ability in solving variational problems and integral equations.
3. To use calculus of variation to find the extremum of a functional.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Finding the solution of Fredholm and Volterra Integral equations. |
| | CO2 | Explaining the method to reduce the differential equations to Integral equations. |
| | CO3 | Solving Maximum or minimum of a functional using Calculus of Variation Techniques. |
| | CO4 | Analyzing the Euler's finite difference method, the Ritz method and Kantorovich's method. |
| | CO5 | Evaluating Fourier sine and cosine transforms of given function and to solve PDE's by means of Fourier transforms. |

**Syllabus**

**UNIT I** **(24 Hours)**

Fourier Transforms: **Fourier sine and cosine transforms*** – Fourier transforms of derivatives – The Calculation of the Fourier transforms of some simple functions – The convolution integral – Parseval's theorem for cosine and sine transforms – the solution of PDEs by means of Fourier transforms – Laplace's equation in a half plane, infinite strip, semi infinite strip – Solutions of the Diffusion equation - the linear diffusion equation on a semi - infinite line – the two- dimensional diffusion equation.

**UNIT II** **(24 Hours)**

Introduction: Integral equations with separable kernels- Reduction to system of algebraic equations, Fredholm alternative – an approximate method, Fredholm integral equations of the first kind, method of successive approximations – Iterative scheme, Volterra integral equation, some results about the resolvent kernel, classical Fredholm theory- Fredholm's method of solution-Fredholm's first, second, third theorems.

25PMA412

**UNIT III** **(24 Hours)**

Application to ordinary differential equation – Initial value problem – boundary value problems– singular integral equation – Abel integral equation.

**UNIT IV** **(24 Hours)**

Calculus of Variations- Variation and its properties – Euler's equation – **functionals of the form** $\int_{x_0}^{x_1} F(x, y_1, y_2, ....., y_n, y_1', y_2', ....., y_n')\, dx$ ***** – functional dependent on higher order derivatives – functionals dependent on the functions of several independent variables – variational problems in parametric form –some applications.

**UNIT V** **(24 Hours)**

Direct Methods- Euler's finite difference method- the Ritz method – Kantorovich's method.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Books**

1. Ian. N.Sneddon, The use of integral Transforms, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1979. (For unit I only)

   Unit I Chapter 2 Sections 2.4 – 2.7, 2.9 , 2.10, 2.16.1 (a), (b), (c), 2.16 .2 (a), (b)

2. Ram. P.Kanwal, Linear equations theory and technique, Academic Press, New York & London, 1971. (For units II and III)

   Unit II Chapter 1 to Chapter 4

   Unit III Chapter 5 Sections 5.1 – 5.2

   Chapter 8 Sections 8.1 – 8.2

3. L.Elsgolts, Differential equations and the calculus of variations, MIR Publishers, Moscow, 1980. (For unit IV and V)

   Unit IV Chapter 6 Sections 6.1- 6.7

   Unit V Chapter 10 Sections 10.1- 10.4

**Reference Books**

1. Merle C Potter and Jack Goldberg, Mathematical Methods, 2nd Edition, Prentice Hall of India (P) Ltd, New Delhi, 2000.
2. C.Corduneanu, Integral Equations and Applications, Cambridge University Press, Cambridge, 1991
3. R.Weinstock, Calculus of Variations with Applications to Physics and Engineering, McGraw-Hill Book Co., Inc.,NewYork, 1952.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | M | H | S | M |
| **CO2** | H | H | S | M | H |
| **CO3** | H | S | H | H | H |
| **CO4** | H | H | H | S | S |
| **CO5** | S | H | S | H | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA413

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Title of the Paper** | | Core Paper 13 CONTROL THEORY | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>8 | **Total Hours**<br>120 | **Credits**<br>6 | **Skill Development** |

## Course Objectives

1.To know the basic results of Differential Equations and Fixed Point Methods.

2. To study the basics of observability, controllability, stability, stabilizability, optimal Control of linear and nonlinear system.

3. To develop skills to review research papers in the field of Controllability Problems.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Choosing ordinary differential equations through state-space representations towards analyzing and designing dynamical systems. |
| | CO2 | Understanding mathematical techniques to formulate and solve control theory problems. |
| | CO3 | Solving the stability of the given linear and nonlinear system using matrix theory. |
| | CO4 | Analyzing various optimal control formulations and necessary conditions of optimal control. |
| | CO5 | Evaluating the stabilization and optimal control via feedback control. |

## Syllabus

**Unit I** **(24 Hours)**

Motivation – **Basic Results of Differential Equations*** – Fixed point Methods – Observability of Linear systems – Non linear systems.

**Unit II** **(24 Hours)**

Controllability of Linear systems – Non linear systems.

**Unit III** **(24 Hours)**

Stability of Linear systems – Perturbed Linear systems – Non linear systems.

**Unit IV** **(24 Hours)**

Stabilizability –**Stabilization Via linear feedback control*** – The controllable Subspace – Stabilization with Restricted Feedback**.**

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**Unit V** **(24 Hours)**

Optional Control – Linear Time varying systems – Time Invariant systems – Non linear systems.

*** denotes self study (Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

1. K. Balachandran and J. P. Daur, Elements of Control Theory, Narosa Publishing House, New Delhi, 2nd Edition 2012.
   - Unit I Chapter 1 Sections 1.1, 1.2, 1.3
   - Chapter 2 Sections 2.1, 2.2
   - Unit II Chapter 3 Sections 3.1, 3.2
   - Unit III Chapter 4 Sections 4.1, 4.2, 4.3
   - Unit IV Chapter 5 Sections 5.1, 5.2, 5.3
   - Unit V Chapter 6 Sections 6.1, 6.2, 6.3

**Reference Books**


1. Gass.S, Control system theory and Applications, Pearson Education Ltd, Bangalore, 2007.
2. H. Hermes and J.P.Lasalle, Functional Analysis and Time Optimal Control, Academic Press, New York , 1969.
3. R.E.Kalman, P.L.Falband M.A. Arbib, Topics in Mathematical Systems Theory, McGraw Hill, New York, 1969.
4. D.L. Russell, Mathematics of Finite Dimensional Control Systems, Marcel Dekker, New York, 1979.


**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | H | S | M |
| **CO2** | H | H | S | M | H |
| **CO3** | M | S | H | H | H |
| **CO4** | H | H | H | S | S |
| **CO5** | S | H | H | S | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA414

| **Programme Code** : 02 | | **M.Sc. Mathematics** | | |
|---|---|---|---|---|
| **Title of the Paper** | | **Core Paper 14 –** PROGRAMMING IN PYTHON THEORY | | |
| **Batch** 2025-2027 | **Hours / Week 5** | **Total Hours 75** | **Credits 3** | **Employability/ Skill Development** |

**Course Objectives**

1. To introduce the fundamentals of Python Programming.
2. To teach about the concept of Functions in Python.
3. To impart the knowledge of Lists, Tuples, Files and Directories.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concept of operators, data types, Loops and control statements in Python programming. |
| | CO2 | Understanding the concepts of Input / Output operations in file. |
| | CO3 | Applying the concept of functions and classes. |
| | CO4 | Analyzing the structures of list, tuples and maintaining dictionaries. |
| | CO5 | Justifying the usage of exception handling. |

**Syllabus**

**Unit I** **(15 Hours)**

Introduction to Python**:** Introduction - Python Overview - Getting Started with Python – ***Comments** - ***Python Identifiers** - Reserved Keywords – Variables - Standard Data Types. Operators - Statement and Expression - String Operations - Boolean Expressions - Control Statements - Iteration - While Statement - Input from Keyboard.

**Unit II** **(15 Hours)**

Functions: Built-in functions - Composition of functions - User defined functions - Parameters and Arguments - Function Calls - The return Statement - Python Recursive Function - The Anonymous Functions – Writing Python Scripts. Strings**:** Compound Data Type - Len Function - String Slices - Strings are Immutable - String Traversal - Escape Characters - String Formatting Operator - String Formatting Functions.

**Unit III** **(15 Hours)**

Lists: Values and Accessing Elements - Lists are Mutable - Deleting Elements from List- Built-in list Operators - Built-in List Methods. Tuples**:** Creating Tuples - Accessing values in Tuples - Tuples are Immutable - Tuple Assignment - Tuples as Return Values - Variable Length Argument Tuples - Basic Tuple Operations - Built-in Tuple Functions.

25PMA414

**Unit IV** **(15 Hours)**

Dictionaries: Creating a Dictionary - Accessing values in a Dictionary - Updating Dictionary - Deleting elements from Dictionary - Properties of Dictionary keys - Operations in Dictionary - Built-in Dictionary methods. Classes and Objects: Overview of OOP - Class Definition - Creating Objects - Objects as arguments - Objects as Return Values - Built-in class attribute - Inheritance - Method Overriding - Data Encapsulation - Data Hiding.

**Unit V** **(15 Hours)**

Files: Text files: Opening a file - Closing a file - The file object attributes - Writing to a file - Reading from a file - Renaming a file - Deleting a file - Files related methods. Directories: mkdir(), chdir(), getcwd(), rmdir(). Exceptions: Built-in exceptions - Handling exceptions - Exception with arguments - User defined exceptions.

*** - Self Study and questions for examinations may be taken from the self study portions also.**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book:**

1. E. Balagurusamy, Introduction to Computing and Problem Solving using Python, First Edition , Fifth Reprint (2020), McGraw-Hill Education (India) Pvt. Ltd, Chennai.

**Reference Books:**

1. Ashok NamdevKamthane, Amit Ashok Kamthane, Programming and Problem Solving with Python, McGraw-Hill, First Edition, 2017.
2. Martin Jones, Python for Complete Beginners, Createspace Independent Publisher, First Edition, 2015.
3. S.A. Kulkarni, Problem Solving and Python Programming, Yes Dee Publishing Pvt. Ltd, First Edition, 2017.

**Mapping**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | S | H | M | S | S |
| **CO2** | S | S | H | H | H |
| **CO3** | H | M | S | S | H |
| **CO4** | M | S | M | H | S |
| **CO5** | S | M | S | H | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

25PMA4CM

| **Programme Code** : 02 | | **M.Sc. Mathematics** | | |
|---|---|---|---|---|
| **Title of the Paper** | | **Core Practical 2–** Programming in Python – Practical | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>**2** | **Total Hours**<br>**30** | **Credits**<br>**2** | **Employability/ Skill Development** |

**Course Objectives**

1. To gain knowledge about the concepts of Python programming.
2. To solve algebraic and non-linear ordinary differential equations using Python programs.
3. To enhance the students to develop the program writing skills for mathematical problems.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K3- K5 | CO1 | Finding the GCD of two integers using Python program. |
| | CO2 | Demonstration of some concepts of Number theory using Python. |
| | CO3 | Utilizing Python program to read and write csv file. |
| | CO4 | Analyzing the data using Statistical tools and finding the interpolation values using Python. |
| | CO5 | Applying, compiling and debugging programs with the help of Python. |

## LIST OF PRACTICAL PROGRAMS

1. Program to determine the Greatest Common Divisor (GCD) of any two integers.
2. Program to generate prime numbers up to n integers.
3. Program to generate Fibonacci prime numbers up to n integers.
4. Program to find the number of instances of different digits in a given number.
5. Program to find the number of vowels and consonants in a text string.
6. Program to find the 1st, 2nd and 3rd highest element in a list.
7. Program to create a table.
8. Program to add, subtract and multiply two matrices.
9. Program to find the interpolation value using Lagrange's method.
10. Program to read and write a csv file and plot the given data.
11. Program to find the measures of central tendency.
12. Program to calculate the correlation coefficient.
13. Program to represent the given data as a Histogram.
14. Program to perform word count on a given text file.
15. Program to demonstrate Inheritance.

25PMA4CM

| **Distribution of Marks in ESE** | | | **CIA** | | |
|---|---|---|---|---|---|
| Experiment | : | 50 | CIA Practical | : | 25 |
| Record | : | 10 | Exam | | |
| **Total** | | **60** | Attendance | : | 5 |
| | | | Observation Note book | : | 10 |
| | | | **Total** | | **40** |

To be awarded jointly by the internal and external examiners

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | S | H | H | S |
| **CO2** | M | M | H | H | M |
| **CO3** | H | S | S | S | M |
| **CO4** | S | H | H | S | H |
| **CO5** | H | M | S | H | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA4Z1

| **Programme Code** : 02 | | **M.Sc. Mathematics** | | |
|---|---|---|---|---|
| **Title of the Paper** | | Project and Viva voce | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>- | **Total Hours**<br>- | **Credits**<br>**2** | **Employability/ Skill Development** |

## Course Objectives

1.To study the basic concepts related to the Project work.

2.To know the respective research fields.

3. To know the concept of writing a dissertation in an effective way.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 to K5 | CO1 | Remembering the fundamental notions to undergo a project |
| | CO2 | Understanding the necessary concepts in the respective area of research |
| | CO3 | Applying the relative notions in the respective areas and finding the results. |
| | CO4 | Analyzing results with the existing results. |
| | CO5 | Interpreting the results with suitable examples. |

**Distribution of Marks in ESE**

Dissertation : 60

Viva voce : 20

**Total 80**

**Internal**

Project Review : 15

Attendance : 5

**Total 20**

To be awarded jointly by the internal and external examiners

## Mapping

| **PSO / CO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
|---|---|---|---|---|---|
| **CO1** | S | S | S | H | H |
| **CO2** | H | S | S | M | S |
| **CO3** | S | H | H | S | M |
| **CO4** | H | S | S | M | S |
| **CO5** | S | H | M | S | H |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

# Major Elective Papers

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| Major Elective Paper -FLUID DYNAMICS | | | | |
| **Batch** 2025-2027 | **Hours / Week** 7 | **Total Hours** 105 | **Credits** **5** | **Skill Development** |

**Course Objectives**

**1.**To have a good understanding of the fundamental equation of viscous compressible fluid.

**2.**To enable to Bernoulli equations, Momentum theorems and its applications.

**3.**To understand the motion of solid bodies in fluid and sound knowledge of boundary layer theory.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Defining the fundamental aspects of fluid flow behavior. |
| | CO2 | Classifying the flow patterns of a fluid (gas or liquid) depend on its characteristic. |
| | CO3 | Utilizing the fluid dynamics to analyze the flow of air over the surface to calculate pressure, changes in velocity using the Blasius's equation. |
| | CO4 | Analyzing the steady state kinetic energy equation for fluid flow systems and estimate pressure drop in fluid flow systems. |
| | CO5 | Interpret the solution of boundary layer equation. |

**Syllabus**

**UNIT I** **(21 Hours)**

**Introductory Notions – Velocity – Stream Lines and path lines – Stream tubes and Filaments – Fluid Body – Density –pressure*.** Differentiation following the fluid – Equation of continuity – Boundary conditions (Kinematical and physical) - Rate of change of linear momentum – Equation of motion of an inviscid fluid.

**UNIT II** **(21 Hours)**

Euler's momentum theorem - conservative forces - Bernoulli's theorem in steady motion – Energy equation for inviscid fluid – circulation – Kelvin's theorem – vortex motion – Helmholtz equation.

**UNIT III** **(21 Hours)**

**Two-dimensional motion*** – two-dimensional functions – complex potential -Basic singularities – source, vortex and doublet. Circle theorem - Flow past a circular cylinder with circulation – conformal transformation – Blasius's theorem – lift force.

**UNIT IV** **(21 Hours)**

Viscous flow – Navier Stokes Equations – vorticity and circulation in a viscous fluid – steady flow through an arbitrary cylinder under pressure – steady couette flow between cylinders in relative motion – steady flow between parallel planes.

**UNIT V** **(21 Hours)**

TheLaminar boundary layer in incompressible flow - Boundary layer concept – Boundary layer equations. Displacement thickness – momentum thickness – kinetic energy thickness – integral equation of boundary layer – flow parallel to semi-infinite flat plate – Blasius's equation and its solution in series.

*** denotes self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Books**

1. L.M.Milne Thomson, Theoretical Hydro dynamics, Macmillan Company, Vedition, 1968. (For Units I and II)

| | | |
|---|---|---|
| Unit I | Chapter 1 | Sections1.0 – 1.3 |
| | Chapter 3 | Sections 3.10 – 3.40 (omit sections 3.32) |
| Unit II | Chapter 3 | Sections 3.41 to 3.53 (omit sections 3.44) |

2. N.Curle and H.J.Davies, Modern Fluid Dynamics – Vol. I, D.Vannostrand Company Ltd, London, 1968. (For Units III, IV and V)

| | | |
|---|---|---|
| Unit III | Chapter 3 | Sections 3.1 – 3.7 (omit 3.4 & 3.5.3) |
| Unit IV | Chapter 5 | Sections 5.1 to 5.3 (omit 5.3.4 and 5.3.5) |
| Unit V | Chapter 6 | Sections 6.1 – 6.3 (omit 6.2.2 and 6.3.2 to 6.3.5) |

**Reference Books**

1. F.Chorlton, Text book of Fluid Dynamics , CBS Publishers and distributors, New Delhi-32,1998.
2. M.D.Raisinghawia, Fluid Dynamics, S.Chand and Company Ltd, New Delhi - 55, 1995.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | M | H | H |
| **CO2** | H | S | M | M | H |
| **CO3** | S | H | M | H | H |
| **CO4** | H | M | H | H | S |
| **CO5** | S | H | S | M | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

| **Programme Code :** 02 | M. Sc Mathematics | | | |
|---|---|---|---|---|
| Major Elective Paper - GRAPH THEORY | | | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>7 | **Total Hours**<br>105 | **Credits**<br>**5** | **Skill Development** |

## Course Objectives

1. It enables students to impart the different concepts of theory of graphs.
2. The study helps to modelling the real word problems to get solutions.
3. It motivates the students to pursue research.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering different types of graphs and their applications |
| | CO2 | Understand various operations on graphs |
| | CO3 | Analysing the applications of different parameters of a graph. |
| | CO4 | Applying the concept of chromatic and domination numbers and its real life applications |
| | CO5 | Determining mathematical modeling using graph theory concepts. |

## Syllabus

**Unit I** **(21 hours)**

Basic results - Basic concepts - Sub graphs - Degrees of vertices – Paths Connectedness - Operations on graphs.

**Unit II** **(21 hours)**

Connectivity - Vertex cut and edge cut - Connectivity and edge connectivity - Trees –Definitions, Characterization and simple properties - Centers and Centroids

**Unit III** **(21 hours)**

Independent sets and Matchings: Introduction - Vertex independent sets and Vertex covering - Edge independent sets - Matching and factors - Eulerian and Hamiltonian graphs: Introduction - Eulerian graphs.

**Unit IV** **(21 hours)**

Graph Colorings: Introduction - Vertex colorings - Critical graphs. Planarity: Introduction - Planar and Non Planar graphs - Euler formula and its consequences – $K_5$ and $K_{3,3}$ are non- planar.

**Unit V** **(21 hours)**

Triangulated in graphs: Introduction **– Perfect Graphs*** - Triangulated graphs – Domination in graphs: Introduction - Domination in graphs - Bounds for the domination number.

***denotes Self study (Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Books**

1. R. Balakrishnan& K. Ranganathan, A Text Book of Graph Theory, Springer - Verlag New York, Inc., 2000.
   Unit 1 : Chapter I: Sections: 1.1 – 1.5 and 1.8 (Omit Exercise problems)
   Unit 2 : Chapter III : Sections: 3.1 – 3.2 ; Chapter IV: Sections: 4.1 – 4.3(Omit Exercise problems)
   Unit 3 : Chapter V : Sections : 5.1 – 5.4 ; Chapter VI : Sections: 6.0 – 6.2 (Omit Exercise problems)
   Unit 4 : Chapter VII: Sections : 7.1 – 7.3 ; Chapter VIII : Sections: 8.1 – 8.3 (Omit Exercise problems)
   Unit 5 : Chapter IX: Sections : 9.1 –9.3 ; Chapter X : Sections: 10.1 – 10.3 (Omit Exercise problems)

**References**

1. F. Harary, Graph Theory, Addison-Wesley, Reading Mass., 1969
2. J. A. Bondy and U. S. R. Murty, Graph theory with applications, The Mac Millan Press Ltd., 1976.
3. G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman and Hall, CRC, fourth edition, 2005.
4. J.Clark and D.A.Holton , A First look at Graph Theory, Allied Publishers, New Delhi, 1995.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | H | S | S |
| **CO2** | H | H | S | S | H |
| **CO3** | S | S | H | H | S |
| **CO4** | H | H | S | S | S |
| **CO5** | S | H | S | H | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

| **ProgrammeCode :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Major Elective Paper-** FUNDAMENTALS OF ACTUARIAL MATHEMATICS | | | | |
| **Batch** 2025-2027 | **Hours / Week** 7 | **Total Hours** 105 | **Credits** **5** | **Skill Development** |

**Course Objectives**

1. To use standard techniques of mathematics to solve problems in actuarial science
2. To calculate the values of Annuity and Annuity dues .
3. To know the concepts of Life insurance premiums, Temporary assurance, Whole Life assurance and the values of policies.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concept of Insurance policies and its benefits. |
| | CO2 | Understanding the consequences of events involving risk and uncertainity. |
| | CO3 | Applying various modelling techniques to evaluate quantitative risk analysis. |
| | CO4 | Analysing the appropriate Life insurance plans suitable for the individual or concern. |
| | CO5 | Estimating the policy values and surrender values |

**Syllabus**

**UNIT I** **(21 Hours)**

**Annuities Certain – Present Values*** – Amounts –Deferred Annuities – Perpetuities Present Value of an Immediate Annuity Certain – Accumulated Value of Annuity – Relation between $S_n$ and $a_n$ – Present Value of a Deferred Annuity Certain – Accumulated Value of a Deferred Annuity Certain – The Accumulated Value of an Annuity due of one p.a. for a term of n years – Perpetuity – Present Value of an Immediate Perpetuity of 1 p.a – Present Value of a Perpetuity due of 1 p.a – Deferred Perpetuity with Determent Period of m years – Mortality Table – The Probabilities of Survival and Death.

**UNIT II** **(21 Hours)**

**Life Insurance Premiums – General Considerations*** – Assurance Benefits – Pure Endowment Assurance – Endowment Assurance – Temporary Assurance or Term Assurance – Whole Life Assurance – Pure Endowment Assurance – Endowment Assurance

– Double Endowment Assurance – Increasing Temporary Assurance – Increasing Whole Life Assurance – Commutation Functions $D_x$,$C_x$,$M_x$ and $R_x$ – Expressions for Present Values of Assurance - Benefits in Terms of Commutation Functions – Fixed Term (Marriage) Endowment – Educational Annuity Plan.

**UNIT III** **(21 Hours)**

Life Annuities and Temporary Annuities – Commutation Functions $N_x$ – To Find the Present Value of an Annuity Due of Re. 1 p.a for Life – Temporary Immediate Life Annuity – Expression for $a_x:_n$ - Deferred Temporary Life Annuity – Variable Life Annuity - Increasing Life Annuity – Commutation Function $S_x$ – Increasing - Temporary Life Annuity – Tables of Life Annuity and Temporary Life Annuity - Variations in the Present Values of Annuities – Life Annuities Payable at Frequent Intervals.

**UNIT IV** **(21 Hours)**

Net Premiums for Assurance Plans – Natural Premiums – Level Annual Premium – Symbols for Level Annual Premium under Various Assurance Plans – Mathematical Expressions for level Annual Premium under Level Annual Premium under Various Plans for Sum Assure of Re. 1 – Net Premiums – Consequences of Charging Level Premium – Consequences of Withdrawals – Net Premiums for Annuity Plans – Immediate Annuities Deferred Annuities.

**UNIT V** **(21 Hours)**

Premium Conversion Tables – Single Premium Conversion Tables – Annual Premium Conversion Tables – Policy Values - Two Kinds of Policy Values – Policy Value in Symbols – Calculation of Policy Value for Unit Sum Assure – Numerical Example: Retrospective Method and Comparison with Prospective Value – Derivative of Theoretical Expressions for Policy Value, ${}_tV_x$ by the Retrospective Method and Prospective Method – Other Expressions for Policy Value – Surrender Values – Paid up Policies – Alteration of Policy Contracts.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

Mathematical Basis of Life Assurance, Insurance Institute of India, Mumbai, June 2007.

| | |
|---|---|
| Unit I | Sections II.1 to II.27 |
| | Sections V.1 to V.7 |
| Unit II | Sections VIII.1 to VIII. 6 |
| | Sections IX .1 to IX.19 |
| Unit III | Sections X.1 to X.16 |
| Unit IV | Sections XI.1 to XI.7 |
| | Sections XII.1 to XII.4 |
| Unit V | Sections XIII.1 to XIII.6 |
| | Sections XV.1 to XV.10 |

**Reference Book**

1. Statistics, Insurance Institute of India, Mumbai, 1989.

**Mapping**

| | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
|---|---|---|---|---|---|
| **CO1** | H | S | S | H | S |
| **CO2** | M | S | H | S | H |
| **CO3** | S | H | M | H | M |
| **CO4** | H | S | M | M | S |
| **CO5** | S | M | S | M | S |

S- Strong; H-High; M-Medium; L-Low

| **ProgrammeCode :** 02 | M. Sc Mathematics | | | |
|---|---|---|---|---|
| **Major Elective Paper -** CRYPTOGRAPHY | | | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>7 | **Total Hours**<br>105 | **Credits**<br>**5** | **Skill Development** |

## Course Objectives

1. To enable the students to acquire the knowledge about Classical Cipher Systems**,** Shift Registers and Public Key systems.
2. To be familiar with information security awareness and a clear understanding of its importance.
3. To be exposed to the importance of integrating people, processes and technology.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the basic encryption techniques. |
| | CO2 | Understanding the cryptographic theories, principles and technique used in security properties. |
| | CO3 | Constructing a range of different cryptosystems from an applied view point. |
| | CO4 | Analyzing the methods of Cryptography |
| | CO5 | Explaining public key systems |

## Syllabus

**UNIT I** **(21 Hours)**

Classical Cipher Systems: Introduction – **Transposition ciphers*** – Substitution ciphers – The Haselin Machine.

**UNIT II** **(21 Hours)**

The information the metical approach : The general scheme – The information measure and absolute security – The unicity distance.

**UNIT III** **(21 Hours)**

The Data Encryption Standard : The DES algorithm – Analysis of DES – The modes of the DES.

**UNIT IV** **(21 Hours)**

Shift Registers : Stream and block enciphering – The theory of Finite state machines – shift registers – Random properties of shift register sequences – The generating function.

**UNIT V** **(21 Hours)**

Public Key systems : Introduction – **The RSA system*** – Public Key systems based on elliptic curves.

*** denotes self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

Jan C A Van Der Lubby, Basic Methods of cryptography , Cambridge University Press, 1998.

| | | |
|---|---|---|
| Unit I | Sections | 2.1 to 2.4 |
| Unit II | Sections | 3.1 to 3.3 |
| Unit III | Sections | 4.1 , 4.4 and 4.5 |
| Unit IV | Sections | 5.1 to 5.5 |
| Unit V | Sections | 6.1, 6.2 and 6.5 |

**Reference Books**

K.Blitz N.A., course in number theory and cryptography, Springer verlag, 1988.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | M | S | S | H | S |
| **CO2** | M | S | H | M | H |
| **CO3** | S | H | S | H | M |
| **CO4** | H | S | M | M | S |
| **CO5** | S | H | M | S | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

| **Programme Code :** 02 | **M.Sc Mathematics** | | | |
|---|---|---|---|---|
| **Major Elective Paper : STOCHASTIC PROCESSES** | | | | |
| **Batch** 2025-2027 | **Hours / Week** 7 | **Total Hours** 105 | **Credits** **5** | **Skill Development** |

## Course Objectives

1. To know the basic concepts of Laplace transforms.
2. To study the fundamentals of stochastic process.
3. To know the applications of queuing systems.

## Course Outcomes(CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the basic concepts of Difference equations. |
| | CO2 | Understanding the concepts of Markov chains. |
| | CO3 | Identifying the concepts of Poisson process and related distributions. |
| | CO4 | Analyzing Stochastic process in queuing and reliability. |
| | CO5 | Explaining the Birth and death process in queuing theory |

## Syllabus

**UNIT I** **(21 Hours)**

Generating function – Laplace transforms – Laplace transforms of a probability distribution function Difference equations – Differential difference equations – [*]**Matrix analysis**.

**UNIT II** **(21 Hours)**

Stochastic process – notion – specification – stationary process – Markov chains – Definition and examples – Higher transition probabilities.

**UNIT III** **(21 Hours)**

Classification of states and chains – Determination of Higher transition probabilities – stability of Markov system – limiting behavior.

**UNIT IV** **(21 Hours)**

Poisson process and related distributions – generalization of Poisson process – Birth and death process.

**UNIT V** **(21 Hours)**

Stochastic process in queuing and reliability – queuing systems, m/m/1 models – Birth and death process in queuing theory – Mutti channel models – Bulk Queues.

*** denotes self study (Questions may be asked from these portions also)**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

J. Medhi, Scope and treatment as in "Stochastic Process" ,Wiley Publishers,1994.

**Reference Books**

1. First course in Stochastic Process by Samuel Kartin.
2. Stochastic Process by Srinivasan and Metha (TATA McGraw Hill)
3. Elements of Applied Stochastic Process by V. Narayanan.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | M | H | M | S |
| **CO2** | H | S | M | H | S |
| **CO3** | S | M | M | S | H |
| **CO4** | M | H | S | H | M |
| **CO5** | S | H | M | M | H |

S- Strong; H-High; M-Medium; L-Low

| **Programme Code :** 02 | **M.Sc Mathematics** | | | |
|---|---|---|---|---|
| **Major Elective Paper –** Mathematical Modeling | | | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>7 | **Total Hours**<br>105 | **Credits**<br>**5** | **Skill Development** |

**Course Objectives**

1. To understand physical systems through Mathematical models.
2. To understand applications of differential equations, difference equations and graph theory in Mathematical modelling.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the basic concepts of differential equations. |
| | CO2 | Understanding the properties Mathematical Models. |
| | CO3 | Identifying difference equations through modeling. |
| | CO4 | Analyzing the concepts of seven bridge problem. |
| | CO5 | Evaluating the matrices associated with the directed graphs |

**Syllabus**

**UNIT I** **(21 Hours)**

Ordinary differential equation – Linear growth model – Growth of science and scientists – Non-linear growth and decay models – Diffusion of glucose or a medicine in the bloodstream. .

**UNIT II** **(21 Hours)**

Modelling in population dynamics – Prey-predator models – Competition models – Multi-species models – Modeling of epidemics – Simple epidemic models – A model for diabetic-mellitus.

**UNIT III** **(21 Hours)**

Modeling in second order ODE – Modelling of planetary motion – Motion under central force – *__Circular motion__ – Elliptic motion of a satellites – Rectilinear motion.

**UNIT IV** **(21 Hours)**

Modeling through difference equations – Linear difference equations – Obtaining complementary function by use of matrices – Harrod model – Cob-web model – Applications of Actuarial Science.

**UNIT V** **(21 Hours)**

Modelling through graphs – Seven bridge problem – representing results of tournament – Genetic graph – Food web – Communication network – Matrices associated with a directed graph – Detection of clique – Terms of signed graph.

*** denotes self study (Questions may be asked from these portions also)**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Books**

1. T.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Age International Pvt.Ltd., Reprint 2013.

| | | |
|---|---|---|
| Unit I | Chapter 2 | Sections 2.1- 2.3, 2.4.2 |
| Unit II | Chapter 3 | Sections 3.1.1-3.1.3, 3.2.1 & 3.5.1 |
| Unit III | Chapter 4 | Sections 4.1.1 – 4.3.1 |
| Unit IV | Chapter 5 | Sections 5.2.1 – 5.2.6,5.3.1,5.3.2& 5.3.4 |
| Unit V | Chapter 7 | Sections 7.1.2 – 7.3.1 |

**Reference Books**

1. J.N.Kapur, Mathematical Models in Biology and Medicine, Affiliated East-West Press, New Delhi, 1985.
2. R. Olink, Mathematical Models in Social and Life Sciences, 1978.

**Mapping**

| **PSO / CO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
|---|---|---|---|---|---|
| **CO1** | S | H | M | S | H |
| **CO2** | H | M | S | H | M |
| **CO3** | M | H | M | S | H |
| **CO4** | H | S | M | H | M |
| **CO5** | S | H | M | S | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

# Non Major Elective Papers

| **ProgrammeCode :** 02 | M. Sc Mathematics | | | |
|---|---|---|---|---|
| Non Major Elective Paper - SYSTEMS ANALYSIS AND DESIGN | | | | |
| **Batch** 2025-2027 | **Hours / Week** 4 | **Total Hours** 60 | **Credits** **4** | **Employability/Skill Development** |

## Course Objectives

1. To enable the learners to understand the concepts of Foundations for systems development, Structuring system requirements and Designing Data bases.
2. To explain the principles, methods and techniques of systems development.
3. To elaborate on the application areas for different types of methods.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Defining and describe the phases of the system development life cycle. |
| | CO2 | Demonstrating the forms and reports and designing interfaces. |
| | CO3 | Building the system development alternatives. |
| | CO4 | Examining the system analysis problems. |
| | CO5 | Evaluating the developed system for implementation and maintenance |

## Syllabus

**UNIT-I** **(12 Hours)**

Foundations for systems development: The systems development environment - Succeeding as a systems analyst – Automated tools for systems development - Initiating and planning systems development projects.

**UNIT-II** **(12 Hours)**

Analysis: Determining system requirements – Traditional methods – Modern methods – Radical methods – Internet Development: Determining system requirements – structuring system requirements: Process modeling.

**UNIT-III** **(12 Hours)**

Structuring system requirements: Logic modeling - Structuring system requirements : conceptual data modeling.

**UNIT-IV** **(12 Hours)**

Design: Designing databases - **Designing Forms and Reports – Designing**

**Interfaces and dialogues*** – Finalizing Design Specifications.

**UNIT-V** **(12 Hours)**

Implementation and Maintenance: System Implementation – Maintaining

Information systems.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

Jeffrey A. Hoffer, Joey F. George, Joseph S.Valacich , Modern Systems Analysis and Design, 3rd edition, Pearson Education, 2003.

| | | |
|---|---|---|
| Unit I | Sections | 1, 2, 4, 6 |
| Unit II | Sections | 7, 8, 9 (Process Modeling) |
| Unit III | Sections | 9,10 |
| Unit IV | Sections | 12, 13, 14, 15 |
| Unit V | Sections | 17, 18 |

**Reference Books**

1. Elias M Awad, Systems Analysis and Design, GalgotiaPubl, 2nd Edition,1996.

2. James A Senn, Analysis and Design of Information Systems, TMH Publ, 2nd Edition,1989.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | S | H | H | H |
| **CO2** | S | M | H | H | S |
| **CO3** | S | M | H | H | S |
| **CO4** | H | M | S | S | M |
| **CO5** | S | H | H | M | M |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

**25PGI4N2**

| **Programme Code:** | **PG** | | | |
|---|---|---|---|---|
| **NON-MAJOR ELECTIVE PAPER : INFORMATION SECURITY** | | | | |
| **Batch** | **Semester** | **Hours/Week** | **Total Hours** | **Credits** |
| **2025-2027** | **IV** | **4** | **60** | **4** |

## COURSE OBJECTIVES

- Students will identify the core concepts of Information security.
- To examine the concepts of Information Security.
- To design and implement the security features for IT and Industrial sectors.

## COURSE OUTCOMES

After Completion of the Course the student will be able to

| | | |
|---|---|---|
| K1 | CO1 | To Learn the principles and fundamentals of information security. |
| ↕ | CO2 | To Demonstrate the knowledge of Information security concepts |
| | CO3 | To Understand about Information Security Architecture. |
| | CO4 | To Analyze the various streams of security in IT and Industrial sector. |
| K5 | CO5 | To know about Cyber Laws and Regulations. |

## SYLLABUS

**UNIT I** **(12 Hours)**

Information Security basics: Definition of Information Security - History of Information Security - Characteristics of Information Security - Components of Information Security - Security System Development Life Cycle (SDLC). Information Security for technical administrators: Server Security – Network security- Social Media Security.

**25PGI4N2**

**UNIT II** **(12 Hours)**

Cryptography: Basic concepts - plain text - Cipher text - Encryption Principles - CRYPT Analysis - Cryptographic Algorithms - Cryptographic Tools – Authentication -Biometrics* - passwords - Access Control Devices - Physical Security - Security and Personnel. Language-based Security: Analysis of code for security errors, Safe language and sandboxing techniques.

**UNIT III** **(12 Hours)**

Firewalls, Viruses & Worms & Digital Rights Management : Viruses and Worms- Worms - Digital Rights Management – Firewalls - Application and Circuit Proxies - Stateful Inspection - Design Principles of Firewalls. Logical Design: Access Control Devices- Physical Security-Security and Personnel - NIST Models-VISA International Security Model- Design of Security Architecture-Planning for Continuity.

**UNIT IV** **(12 Hours)**

Hacking : Introduction – Hacker Hierarchy – Password cracking – Phishing - Network Hacking -Wireless Hacking - Windows Hacking - Web Hacking*- Ethical Hacking. Security Investigation: Need for Security- Business Needs-Threats- Attacks- IP Addressing and Routing - Social Media

**UNIT V** **(12 Hours)**

Cyber Laws : What is Cyber Law? - Need for Cyber laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities.

***Self study questions for examination may be taken from the self-study portions also.**

Teaching Methods:

Chalk and Talk, Power point presentation, Seminar, Brainstorming, Assignment, Google Classroom.

**25PGI4N2**

**TEXT BOOK:**

Information Security –Text book prepared by Kongunadu Arts and Science College, Coimbatore -29, 2022.

**REFERENCE BOOKS:**


1 Charles P Pfleeger and Shai Lawrence Pfleeger, **"Security in Computing",** Fourth & Third Edition, Prentice Hall, 2007 & 2011.
2 Ross J. Anderson and Ross Anderson, "Security Engineering: A guide to building Dependable Distributed System", Wiley,2009.
3 Thomas R. Peltier, Justin Peltier and John Bleckley, "Information Security Fundamentals",2nd Edition, Prentice Hall 1996.
4 Gettier, Urs E. Information Security: Strategies for Understanding and Reducing Risks John Wiley & Sons, 2011.
5 "Principles of information security". Michael Whiteman and Herbert J. Mattord,2012.
6 Information security -Marie wright and John kakalik,2007.
7 Information security Fundamentals- Thomas R. Peltier, Justin Peltier and John Blackley-2005.
8 Information Security theory and practical PHI publication, Dhiren R. Patel-2008.
9 Debby Russell and Sr.G.T. Gangemi," computer Security Basics,2nd edition, O'Reilly Media,2006.


**Question Paper Pattern**

**Duration: 3 hrs** **Max: 75 marks**

**Section - A** (10x1=10)

**Choose the correct answer**

**Section - B** (5x5=25)

**Short answer questions, either or type, one question from each unit.**

**Section - C** (5x8=40)

**Essay answer questions, either or type, one question from each unit.**

**25PGI4N2**

## CIA EXAMINATION MARK BREAKUP

| S. NO | DISTRIBUTION COMPONENT | MARKS |
|---|---|---|
| 1. | CIA I – 75 Marks Converted to 30 | **30** |
| 2. | CIA II – 75 Marks Converted to 30 | **30** |
| 3. | Assignment I | **10** |
| 4. | Assignment II | **10** |
| 5. | Attendance | **05** |
| 6. | Any Case Study related to Information Security | **15** |
| | **Total** | **100** |

| **ProgrammeCode :** 02 | M. Sc Mathematics | | | |
|---|---|---|---|---|
| **Non Major Elective Paper**- FUZZY LOGIC AND NEURAL NETWORKS | | | | |
| **Batch**<br>2025-2027 | **Hours / Week**<br>4 | **Total Hours**<br>60 | **Credits**<br>**4** | **Skill Development** |

## Course Objectives

1. To understand the concepts of fuzzy sets, fuzzy operations and fuzzy logic.
2. To know the concepts of neural networks and neuro-modeling.
3. To study the basics of neural network architectures and some learning algorithms.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Recalling the difference between crisp set theory and fuzzy set theory. |
| | CO2 | Explaining the concepts of operations on fuzzy set. |
| | CO3 | Applying the learning methods in neural network architectures. |
| | CO4 | Examining the Back propagation learning algorithm. |
| | CO5 | Demonstrating the fuzzy set theory and neural networks in real applications |

## Syllabus

**UNIT I** **(12 Hours)**

Fuzzy Sets: Crisp sets – Fuzzy sets: Basic Types, Basic concepts – Additional properties of $\alpha$-cuts – Representations of fuzzy sets – Extension prinicple for fuzzy sets.

**UNIT II** **(12 Hours)**

Operations On Fuzzy Sets:Types of operations – fuzzy complements – fuzzy intersections : t-Norms – Fuzzy unions : t-conorms.

**UNIT III** **(12 Hours)**

Fuzzy Logic: Classical logic – multivalued logics – **fuzzy propositions** – fuzzy quantifiers.

**UNIT IV** **(12 Hours)**

Fundamentals Of Neural Networks: Basic concepts – Model of an Artificial Neuron – Neural Networks Architectures – **characteristics of Neural Network** – Learning Methods – Early Neural Network Architectures.

**UNIT V** **(12 Hours)**

Backpropagation Networks: Introduction – Architecture of a Backpropagation Networks – Backpropagatiopn Learning.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

1. George J.Klir and Boyman, Fuzzy sets and Fuzzy Logic – Theory and Applications, PHI Learning

Pvt. Ltd., 2012. ( for units – I, II and III )

2. S. Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithms,

PHI Learning Pvt. Ltd., 2008. ( for units – IV and V )

| | | |
|---|---|---|
| Unit I | Chapter1,2 | Sec 1.2,1.3,1.4,2.1,2.2,2.3 |
| Unit II | Chapter 3 | Sec 3.1 – 3.4 |
| Unit III | Chapter 8 | Sec 8.1 – 8.3 |
| Unit IV | Chapter 2 | Sec 2.1,2.3 – 2.6,2.9 |
| Unit V | Chapter 3 | Sec 3.1,3.2. |

**Reference Books**

George J.Klir and Tina A.Folger, Fuzzy Sets,Uncertainty and Information, Prentice-Hall of India Private Limited-Fourth printing-June 1995.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | M | H | S |
| **CO2** | H | S | M | M | S |
| **CO3** | M | M | S | S | H |
| **CO4** | S | H | H | S | M |
| **CO5** | S | H | M | S | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

| **Programme Code :** 02 | | M. Sc Mathematics | | |
|---|---|---|---|---|
| **Non Major Elective Paper** -MEASURE AND INTEGRATION | | | | |
| **Batch** 2025-2027 | **Hours / Week** 4 | **Total Hours** 60 | **Credits** **4** | **Skill Development** |

**Course Objectives**

1. To understand the concepts of Measurable functions and Integrable functions.
2. To know about Lebesgue measure and Lebesgue integral.
3. To apply measurable functions in convergence theorems and The Radon – Nikodym theorem.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concepts of Measure and outer measure |
| | CO2 | Classifying the difference between various measures |
| | CO3 | Applying measure theory in theorems like monotone convergence theorem , bounded convergence theorem . |
| | CO4 | Analyzing $L^P$ spaces. |
| | CO5 | Demonstrating the concepts of differentiation and integration in terms of Lebesgue |

**Syllabus**

**Unit I** **(12 Hours)**

Lebesgue Measure : Introduction, Outer measure, Measurable sets and Lebesgue measure and Measurable functions.

**Unit II** **(12 Hours)**

The Lebesgue Integral : The Lebesgue integral of a bounded function over a set of finite measure, The integral of a non negative function, The general Lebesgue integral.

**Unit III** **(12 Hours)**

Differentiation and Integration **:** Differentiation of monotonic functions, Functions of bounded variation, Differentiation of an integral and Absolute continuity.

**Unit IV** **(12 Hours)**

Measure and Integration**:Measure spaces***, Measurable functions, Integration and General convergence theorems.

**Unit V** **(12 Hours)**

The Radon – Nikodym Theorem**:** Signed measures, The Randon- Nikodym Theorem and The $L^P$ spaces.

*** denotes Self study( Questions may be taken from these portions also).**

**Teaching Methods**

| |
|---|
| Smart ClassRoom /Powerpoint presentation /Seminar /Quiz/Discussion /Flipped Class/ peer Learning/ Experiential Learning/Blended learning |

**Text Book**

H.L. Royden , Real Analysis, 3rd Edition, Macmillan Publishing Company, New York, 2007.

| | | |
|---|---|---|
| Unit I | Chapter 3 | (Omit Sections 4 and 6 ) |
| Unit II | Chapter 4 | (Omit Sections 1 and 5 ) |
| Unit III | Chapter 5 | (Omit Section 5 only) |
| Unit IV | Chapter 11 | Sections 1,2,3 and 4. |
| Unit V | Chapter 11 | Sections 5, 6 and 7. |

**Reference Books**

1. Walter Rudin, Principles of Mathematical Analysis, McGraw – Hill.Inc, New York, Third Edition, 1976.
2. G.de Barra, Wiley Eastern, Measure Theory and Integration, New Delhi, 1981.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | H | H | S | H | M |
| **CO2** | M | S | M | M | H |
| **CO3** | S | H | S | H | S |
| **CO4** | S | S | H | S | S |
| **CO5** | S | H | S | M | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

# Extra Departmental Course

**25PMA3XL**

| **Programme Code** : 02 | | | **PG EDC** | | |
|---|---|---|---|---|---|
| Extra Departmental Course: Typesetting in LaTeX Techniques -Practical | | | | | |
| **Batch** 2025-2027 | **Semester III** | **Hours / Week 2** | **Total Hours** 30 | **Credits** 2 | **Skill Development** |

## Course Objectives

1. LaTeX is a typewriting system that is extremely useful for typing and formatting scientific documents.
2. Inserting images is very intuitive and easy in LaTeX.
3. This practical subject is Job and Skill oriented for the students.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 to K5 | CO1 | Choosing LaTeX software to prepare letters in alignments |
| | CO2 | Illustrate tables using LaTeX software |
| | CO3 | Select LaTeX software for preparing dissertation, curriculum vitae and other documents |
| | CO4 | Construct molecular orbital diagrams for Homo and Hetro diatomic molecules by using MO diagram package in LaTeX software |
| | CO5 | Recommending the LaTeX software for preparing Power Point Presentation |

## List of Practical

1. Using LaTeX, type a document in different ways (Left, Right, Center, Justify)

2. Using LaTeX environment, type the following text

   (a) Numbering 1

   - Bullet 1
   - Bullet 2

   (b) Numbering 2

   i. Type 3

3. Using LaTeX environment, type the following text

   1 Chapter

   1.1 Section 1

   1.1.1 Subsection

   1.2 Section 2

**25PMA3XL**

1.2.1 Subsection

4. Include few figures in documents.

5. Using LaTeX, type the following table.

| S.No. | Particulars | Quantity | Total |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

6. Create a frame environment with title LaTeX Beamer presentation.
7. Create references using bibliography environment and cite the references in a document.
8. Using LaTeX, type your own Curriculum Vitae.

## CIA EXAMINATION MARK BREAKUP

## ( For Practical Only)

| S. NO | DISTRIBUTION COMPONENT | MARKS |
|---|---|---|
| 1. | CIA Practical I – 60 Marks Converted to 30 | **30** |
| 2. | CIA Practical I – 60 Marks Converted to 30 | **30** |
| 3. | Continuous Assessment of Practical (Observation to be Submitted*) (15 Experiments/Programs × 2 = 30Marks) | **30** |
| 4. | Record | **05** |
| 5. | Attendance | **05** |
| | **Total** | **100** |

* In case a student is absent for an Experiment/Program conducted on a particular day, the Student will not be allowed to compensate that Experiment/Program and will be awarded zero for that particular Experiment/Program and shall be marked absent. In case any students has an attendance lack; the concerned faculty handling the course in consultation with HoD may permit the student who has an attendance lack to compensate one or two Experiments/Programs as the case may be to enable them to become eligible with mandate of 75% attendance to appear for the Continuous Internal Practical Examinations. However the compensated Experiments/Programs will not be awarded any marks whatsoever.

# JOB ORIENTED COURSE (JOC)

**JOB ORIENTED COURSE (JOC)**

| S.No | JOC | Department |
|---|---|---|
| 1 | Communicative English | English (UG) |
| 2 | Copy Writing | English (PG) |
| 3 | Visual Basic & Oracle | Mathematics (PG) |
| 4 | Maintenance and Troubleshooting of Electronic Equipments& Home Appliances | Physics (PG) |
| 5 | Textile Technology | Chemistry (PG) |
| 6 | Medicinal Plants and Phythotheraphy | Biochemistry (PG) |
| 7 | Plant Tissue Culture | Biotechnology (UG) & (PG) |
| 8 | Biofertilizer&Biocontrol Agents, | Biotechnology (UG) & (PG) |
| 9 | MS Office and Internet | Computer Science (UG) |
| 10 | Adobe Pagemaker and Photoshop | Computer Science & Computer Applications (UG) |
| 11 | Web Designing | Master of Computer Application (PG) |
| 12 | Food Processing and preservation | Plant Biology (PG) |
| 13 | Programming in R | Bioinformatics (PG) |
| 14 | Share Trading Operations | Commerce (PG) |
| 15 | Clinical Nutrition and Dietetics | Zoology (PG) |

# Extra Department Course

## Advanced Learner's Course (Self Study)

25PMA0D1

| | |
|---|---|
| **ProgrammeCode :** 02 | M. Sc Mathematics |
| **Title of the Paper** | ALC 1 DISCRETE MATHEMATICS AND AUTOMATA THEORY |
| **Batch** 2025-2027 | **Credits** 2 |

## Course Objectives

1. To understand mathematical foundations to create mathematical arguments.
2. To enable to know how lattices and Boolean algebra are used as mathematical models of network systems.
3. To know about Automata Theory and its applications.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the concepts of Mathematical logic. |
| | CO2 | Explaining the implication problems using truth table , replacement process and rules of inference. |
| | CO3 | Solving normal forms of given logical expression. |
| | CO4 | Analyzing Karnaugh map for simplifying the Boolean expression. |
| | CO5 | Demonstrating the abstract models of DFA, NFA and Turing machine models. |

## Syllabus

**UNIT I**

**Logic – introduction*** – T F – statements – Connectives - atomic and compound statements – well formed formulae – Truth Table of a formula – Tautology

**UNIT II**

Tautological implications and equivalence of formulae – Replacement process – Functionally complete sets of connectives and duality law - Normal forms – Principal normal forms .

**UNIT III**

Theory of inference – indirect method of proof - open statements - Quantifiers

**UNIT IV**

Boolean algebra – Boolean Polynomials – Karnaugh map (K – map for 5 variables and 6 variables are not included) Switching circuits (simple circuits)

25PMA0D1

**UNIT V**

Theory of Automata – **definition – description*** – transition systems – properties – acceptability of a string by a finite automaton – Non deterministic finite state machines - the equivalence of DFA and NDFA - Mealy and Moore models

**Text Books**

1. M.K Venkataraman ,N.Sridharan and N.Chandrasekaran , Discrete mathematics - The National Publish Company, New Delhi, 2000.

| | | |
|---|---|---|
| Unit I | Chapter 9 | Sections 1, 2, 3, 4, 5, 6, 7 |
| Unit II | Chapter 9 | Sections 8, 9, 10, 11, 12, |
| Unit III | Chapter 9 | Sections 13, 1 4, 15 |
| Unit IV | Chapter 10 | Sections 5, 6, 7, 8 |

2. K.L.P Mishra &N.Chandrasekaran, Theory of computer sciences, Second Edition, Prentice Hall of India Private Ltd., 2001

| | | |
|---|---|---|
| Unit V | Chapter 2 | Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 |

**Reference Books**

1. J.P.Trembley and R.Manohar , Discrete Mathematical Structures with applications to Computer Science, International Edition, McGraw Hill, 1975.

**Mapping**

| PSO / CO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | S | H | S | M | M |
| **CO2** | H | S | H | M | M |
| **CO3** | S | H | S | M | M |
| **CO4** | M | S | M | H | M |
| **CO5** | S | M | S | H | S |

**S** - Strong; **H**-High; **M**-Medium; **L**-Low

25PMA0D2

| | |
|---|---|
| **ProgrammeCode :**02 | M. Sc Mathematics |
| **Title of the Paper** | ALC 2 ASTRONOMY |
| **Batch** 2025-2027 | **Credits** 2 |

## Course Objectives

1. To acquire the knowledge about the celestial objects and planets.
2. Develop skills to design observing projects with research telescopes and projects drawing upon data in the literature and in archives.
3. To be familiar with the appearance of a range of common astronomical objects, such as asteroids, comets, satellites, planets, stars, and galaxies.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 to K5 | CO1 | Defining about the observed properties of physical systems that comprise the known universe. |
| | CO2 | Demonstrate their ability to read, understand, and critically analyze the astronomical/physical concepts |
| | CO3 | Applying their physics and mathematical skills to problems in the areas of planetary science. |
| | CO4 | Analyze to draw valid scientific conclusions and communicate those conclusions in a clear and articulate manner. |
| | CO5 | Determining the Eclipse of a moon |

## Syllabus

**UNIT I** Celestial sphere, Diurnal Motion – Celestial Co-ordinates.

**UNIT II** The Earth: **Zones of Earth*** – Terrestrial Latitudes and Longitudes – Dip of Horizon – Twilight.

**UNIT II** Refraction

**UNIT IV** **Kepler's laws*,** seasons – calendar

**UNIT V** The moon – eclipses.

25PMA0D2

**Text Book**

S.Kumaravelu and SusheelaKumaravelu, Astronomy for Degree classes,

Rainbow Printers, Nagercoil, 2000.

| | | |
|---|---|---|
| Unit I | Chapter II | Sections 39 to 79 |
| Unit II | Chapter III | Sections 1, 2, 5 ,6 |
| Unit III | Chapter IV | |
| Unit IV | Chapter VI | |
| | Chapter VII | Sections 2, 3 |
| Unit V | Chapter XII | |
| | Chapter XIII. | |

**Reference**

1. V.B.Bhatia , Text book for Astronomy and Astrophysics with elements of Cosmology,

   2nd Edition, Narosa Publishing House, New Delhi, 2001.

**Mapping**

| | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
|---|---|---|---|---|---|
| **CO1** | H | M | S | H | S |
| **CO2** | M | S | H | S | H |
| **CO3** | S | H | S | H | M |
| **CO4** | H | S | M | M | S |
| **CO5** | S | H | M | S | H |

S- Strong; H-High; M-Medium; L-Low

25PMA0D3

| | |
|---|---|
| **ProgrammeCode :** 02 | M. Sc Mathematics |
| **Title of the Paper** | ALC 3 INTERNET AND JAVA PROGRAMMING |
| **Batch** 2025-2027 | **Credits** 2 |

**Course Objectives**

1. To understand the difference between C, C++ and Java Programs.
2. To explore the Java Applications and to identify the variations between Stand alone java applications and Web based applications.
3. To provide the advanced concepts in java programming like Package, Multi Thread and Applet.

**Course Outcomes (CO)**

| | | |
|---|---|---|
| K1 to K5 | CO1 | Remembering the basic concepts of OOPs, Data Types, Control Statements and Tokens. |
| | CO2 | Understanding about the java statements. |
| | CO3 | Applying the concept of Package, Thread and Applet in program |
| | CO4 | Inspect the java concepts and get the new innovative ideas. |
| | CO5 | Evaluating the usage of AWT components in java frames. |

**Syllabus**

**UNIT I**

Introduction to internet – Design concepts – Introduction to internet – Resource of Internet – Hardware requirements – Software requirements of internet – internet Service Providers – Internet Addressing. Introduction to web – Using the web – URL schemes – Host names and port numbers – **Using the browser – Hypertext and HTML *.**

**UNIT II**

Java history - Java features – Java Differs from C and C++ - Java and internet – Java Environment – **Java program structure – Java tokens*** – Java statements – Implementing java program – Java virtual machine – command line arguments – constant s- variables – data types – operator and expressions – Decision making and looping.

25PMA0D3

**UNIT III**

Classes – Defining a class – Adding variables – Adding methods – creating objects – Accessing class members – constructors – methods overloading – static numbers – nesting of methods – inheritance – overloading methods – final variables and methods – find class – finalizer methods -abstract methods and class – visibility control – arrays – creating an array – Two dimensional arrays – vectors – Wrapper – classes – interfaces – multiple inheritance.

**UNIT IV**

Packages – Java API packages – Using system packages – naming conventions – creating packages – Accessing a package – using a package – Adding a class to a package – hiding classes. Multithreaded programming – creating threads – extending a thread class – stopping and blocking a thread – life cycle of a thread – using thread methods - thread exceptions – thread priority – Synchronization – managing errors and exceptional.

**UNIT V**

Applet programming – Building Applet code – Applet life cycle – creating an executable applet – AWT – Graphics Programming.

**Text Books**

1. E. Balagurusamy, Programming with Java, Tata Mcgraw Hill, 1998.
2. Harley Hahn, The Internet Complete Reference, 2nd Edition – Tata Mcgraw Hill, 1996.
3. PatricNaughton, Java Hand Book, Tata Mcgraw Hill, 1996

**Reference Books**

1. Wendy G.Lehnert, Internet, 101 Pearson Education Asia, Addison Wesley Longman , 2001.
2. Ned Snell, Teach yourself the Internet in 24 hours, Published by G.C.Jain for Techmedia, 1998.
3. C.Muthu, Programming with Java, Vijay Nicole irnprints Pvt., Ltd, 2004.

25PMA0D3

4. H.M.Deitel, P.J.Deitel, Java ™ Hour to program, Pearson Education pre Ltd., 2005.

**Mapping**

| | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
|---|---|---|---|---|---|
| **CO1** | H | M | S | H | S |
| **CO2** | M | S | H | S | H |
| **CO3** | S | H | S | H | M |
| **CO4** | H | S | M | M | S |
| **CO5** | S | H | H | M | S |

S- Strong; H-High; M-Medium; L-Low