

# ALLIED MATHEMATICS

## Course Structure and Syllabus

(For the candidates admitted from the academic year 2025 - 2026 onwards)

### CHOICE BASED CREDIT SYSTEM (CBCS)



**THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)**

(Accredited with 'A' Grade by NAAC (3rd cycle) with CGPA 3.23 out of 4)

(Affiliated to Bharathidasan University, Tiruchirappalli)

**ELAMBALUR, PERAMBALUR – 621 220**



**B.Sc. Computer Science, Information Technology, Artificial Intelligence &  
Bachelor Computer Application**

(For the candidates admitted from the academic year 2025 - 2026 onwards)

| Sem. | Course Code | Credits | Title of the Course    | AC/ AP / CC /<br>CP / DE / EVS/<br>GS / NME / SE /<br>VE / VAC | Category      |                  |              | Sem.<br>Exam | Max. Marks |     |        |
|------|-------------|---------|------------------------|----------------------------------------------------------------|---------------|------------------|--------------|--------------|------------|-----|--------|
|      |             |         |                        |                                                                | Theo.<br>Hrs. | Tutorial<br>Hrs. | Lab.<br>Hrs. |              | CIA        | ESE | Total. |
| I    | 25UMA1AC1   | 4       | Mathematical Computing | AC                                                             | 5             |                  |              | 3 Hrs.       | 25         | 75  | 100    |

**Pre-Requisite:**

**Course Objectives:** The purpose of learning this course is:

1. Introduce the fundamental concepts of set theory, relations, and functions, and their applications in mathematics and computer science.
2. Develop logical reasoning skills through the study of **propositional logic, logical equivalence, and mathematical induction.**
3. Familiarize students with the basic concepts and operations of **matrices**, solutions of linear systems
4. Introduce **graph theory**, covering various types of graphs, trees, and applications such as spanning trees and shortest paths.
5. Teach the fundamental principles of **finite probability**, including conditional probability, independence, Bayes' theorem, and expected value

**Course Outcomes:**

CO1: Demonstrate understanding of set theory, relations, and functions, and apply them to solve related mathematical problems.

CO2: Apply principles of logic, truth tables, and mathematical induction to construct valid arguments and proofs.

CO3: Perform matrix operations, compute determinants and inverses.

CO4: Understand and apply key concepts in graph theory including Euler and Hamiltonian graphs, spanning trees, and graph traversal algorithms.

CO5: Apply probability rules and techniques to evaluate probabilities, use Bayes' theorem, and compute expected values in finite sample spaces.

**Unit - I** Mathematical Logic 12 Hrs.

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

**Unit - II** Set theory 12 Hrs.

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties.

**Unit - III** Matrices 12 Hrs.

Singular matrices – Inverse of a non-singular matrix using adjoint method - Rank of a Matrix – Characteristic equation – Cayley Hamilton's Theorem (proof not needed)– Simple applications only

**Unit - IV** Solutions of Simultaneous Linear Algebraic Equations 12 Hrs.

Gauss Elimination Method– Gauss Jordan Method - Gauss Jacobi - Gauss Seidel Method.

**Unit - V** Graph Theory 12 Hrs.

Introduction - Representing Graphs - Operations on graphs, Directed Graphs - Graph Isomorphism, Paths – Cycles - Euler Graph - Hamilton Graph - Planar Graphs.

**Trees (Basic Concepts Only):** Introduction, Applications of Trees, Spanning Trees, Minimum Spanning Trees

**Text Books:**

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education. (Unit – I & II)
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002. (Unit – I & II)
3. T.K. Manickavasagam Pillai & Others, Algebra, Vol II, S.V Publications, Pvt.Ltd 2011.(Unit III)
4. S.S.Sastry, “Introductory Methods of Numerical Analysis”, PHI Learning Pvt.Ltd, New Delhi 2010. (Unit – IV)
5. Narsingh Deo, “Graph Theory with Applications to Engineering and Computer Science”. (Unit – V)

**Reference Books:**

1. J.P. Tremblay and R. Manohar Discrete Mathematical Structures with Applications to Computer Science”, Mc Graw Hill Education,2015
1. Elements of Discrete Mathematics- C. L L IU
2. Discrete Mathematics- a) Semyour Lipschutz, Marc Lipson b) Vinay Kumar.
3. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013

**Web Resources:**

1. [https://vemu.org/uploads/lecture\\_notes/17\\_02\\_2023\\_252595088.pdf](https://vemu.org/uploads/lecture_notes/17_02_2023_252595088.pdf)
2. <https://users.encs.concordia.ca/~doedel/courses/comp-232/slides.pdf>
3. [https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/5/\\_UG\\_B.Sc.\\_Information%20Technology\\_129%2051%20Discrete%20Mathematics\\_BSc-IT\\_Sem%20V\\_8236.pdf](https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/5/_UG_B.Sc._Information%20Technology_129%2051%20Discrete%20Mathematics_BSc-IT_Sem%20V_8236.pdf)
4. <https://www2.cs.uh.edu/~arjun/courses/ds/DiscMaths4CompSc.pdf>

| Course Outcomes (COs)               | Program Outcomes (POs) |     |     |     |     |     |     |     | Programme Specific Outcomes (PSOs)    |      |      |      |      |
|-------------------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|------|------|------|------|
|                                     | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1                                  | PSO2 | PSO3 | PSO4 | PSO5 |
| <b>CO1</b>                          | 3                      | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3                                     | 3    | 2    | 2    | 3    |
| <b>CO2</b>                          | 3                      | 3   | 1   | 1   | 2   | 2   | 2   | 1   | 3                                     | 3    | 1    | 1    | 3    |
| <b>CO3</b>                          | 3                      | 3   | 3   | 2   | 1   | 1   | 2   | 2   | 3                                     | 3    | 2    | 1    | 3    |
| <b>CO4</b>                          | 3                      | 3   | 3   | 2   | 3   | 1   | 3   | 2   | 3                                     | 3    | 2    | 2    | 3    |
| <b>CO5</b>                          | 3                      | 3   | 3   | 1   | 2   | 3   | 3   | 1   | 3                                     | 3    | 1    | 2    | 3    |
| <b>Total</b>                        | 15                     | 15  | 12  | 8   | 9   | 9   | 12  | 8   | 15                                    | 15   | 8    | 8    | 15   |
| Overall CO – PO Mapping index = 2.2 |                        |     |     |     |     |     |     |     | Overall CO – PSO Mapping index = 2.44 |      |      |      |      |

1 – Low Correlation

2 – Medium Correlation

3 – High Correlation

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**B.Sc. Computer Science, Information Technology, Artificial Intelligence &  
Bachelor Computer Application**

(For the candidates admitted from the academic year 2025 - 2026 onwards)

| Sem. | Course Code | Credits | Title of the Course   | AC/ AP / CC /<br>CP / DE / EVS/<br>GS / NME / SE /<br>VE / VAC | Category      |                      |                  | Sem.<br>Exam | Max. Marks |     |        |
|------|-------------|---------|-----------------------|----------------------------------------------------------------|---------------|----------------------|------------------|--------------|------------|-----|--------|
|      |             |         |                       |                                                                | Theo.<br>Hrs. | Tutor<br>ial<br>Hrs. | Lab<br>.<br>Hrs. |              | CIA        | ESE | Total. |
| I    | 25UMA2AC2   | 3       | Statistical Computing | AC                                                             | 4             |                      |                  | 3 Hrs.       | 25         | 75  | 100    |

**Pre-Requisite:**

**Course Objectives:** The purpose of learning this course is:

1. Enable students to classify, tabulate, and represent data using diagrams and graphs.
2. Familiarize students with measures of central tendency and their applications.
3. Introduce measures of dispersion and their role in data analysis.
4. Explain the concepts of correlation and regression with real-life applications.
5. Develop analytical and interpretative skills to understand and apply statistical tools.

**Course Outcomes:**

CO1: Understand the basic concepts of statistics, types of variables, and sources of data and present data effectively through classification, tabulation, and graphical tools.

CO2: Calculate and interpret various measures of central tendency.

CO3: Compute and compare different measures of dispersion such as range, standard deviation, etc.

CO4: Analyze the relationship between two variables using correlation techniques.

CO5: Apply regression methods to predict values and understand the trend in data.

**Unit - I Descriptive Statistics**

9 Hrs.

Definition of Statistics - Importance and Scope of Statistics - Limitations of Statistics - Frequency Distribution - Continuous Frequency Distribution - Graphic Representation of a Frequency Distribution – Histogram - Frequency Polygon.

**Unit - II Measures of central tendency**

9 Hrs.

Arithmetic Mean - Properties of Arithmetic Mean - Merits and Demerits of Arithmetic Mean - Geometric Mean - Merits and Demerits of Geometric Mean - Harmonic Mean - Merits and Demerits of Harmonic Mean - Median - Merits and Demerits of Median - Mode – Merits and Demerits of Mode

**Unit - III Measures of dispersion**

9 Hrs.

Range - Quartile Deviation - Mean Deviation - Standard Deviation - Coefficient of Variation - Merits and Demerits

**Unit - IV Correlation**

9 Hrs.

Introduction – Meaning – Scatter Diagram – Karl Pearson’s coefficient of correlation – Correlation coefficient for a Bivariate frequency distribution – Probable error of correlation coefficient - Rank correlation.

**Unit - V Regression**

9 Hrs.

Introduction – Linear regression – Curvilinear regression – Regression curves.

**Text Books:**

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2002, Sultan Chand & Sons publications, New Delhi. (ISBN 81-7014-791-3)

|            |                 |                                  |
|------------|-----------------|----------------------------------|
| UNIT – I   | Chapter – 1 & 2 | Sections 1.2 to 1.4 & 2.1 to 2.2 |
| UNIT – II  | Chapter – 2     | Sections 2.3 to 2.9              |
| UNIT – III | Chapter – 3     | Sections 3.3 to 3.8              |
| UNIT – IV  | Chapter – 10    | Sections 10.1 to 10.6            |
| UNIT – V   | Chapter – 10    | Sections 10.7(10.7.1 to 10.7.5)  |

**Reference Books:**

1. S.P. Gupta, Statistical Methods, Revised Edition 2001.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.
3. T. Veerarajan, Probability, Statistics and Random processes, 3 rd Edition: 2012, TataMcGraw Hill Education Private Limited, New Delhi.
4. S.S.Sastry, “Introductory Methods of Numerical Analysis”, PHI Learning Pvt.Ltd, New Delhi 2010

**Web Resources:**

1. <https://byjus.com/maths/statistics/>
2. [https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg/ug/bsc\\_statistics/I%20Year%20-%20DJS1B%20-%20Descriptive%20Statistics.pdf](https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg/ug/bsc_statistics/I%20Year%20-%20DJS1B%20-%20Descriptive%20Statistics.pdf)
3. <https://www.youtube.com/watch?v=nmIwSQJmX2M>
4. <https://www.teachmint.com/tfile/studymaterial/class-2nd/statisticalmethods/stat-231-full-printed-notespdf/137a97d0-48c1-4613-b674-d785e52a6e95>
5. <https://mu.ac.in/wp-content/uploads/2021/06/USIT204-Numerical-and-Statistical-methods.pdf>

| Course Outcomes (COs)               | Program Outcomes (POs) |     |     |     |     |     |     |     | Programme Specific Outcomes (PSOs)    |      |      |      |      |
|-------------------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|------|------|------|------|
|                                     | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1                                  | PSO2 | PSO3 | PSO4 | PSO5 |
| <b>CO1</b>                          | 3                      | 3   | 3   | 1   | 2   | 3   | 2   | 1   | 3                                     | 3    | 2    | 3    | 1    |
| <b>CO2</b>                          | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 1   | 3                                     | 3    | 1    | 1    | 1    |
| <b>CO3</b>                          | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 1   | 3                                     | 3    | 2    | 1    | 1    |
| <b>CO4</b>                          | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 2   | 3                                     | 3    | 3    | 3    | 1    |
| <b>CO5</b>                          | 3                      | 3   | 3   | 1   | 2   | 3   | 3   | 3   | 3                                     | 3    | 3    | 3    | 1    |
| <b>Total</b>                        | 15                     | 15  | 15  | 5   | 10  | 9   | 11  | 8   | 15                                    | 15   | 11   | 11   | 5    |
| Overall CO – PO Mapping index = 2.2 |                        |     |     |     |     |     |     |     | Overall CO – PSO Mapping index = 2.28 |      |      |      |      |

1 – Low Correlation

2 – Medium Correlation

3 – High Correlation

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**B.Sc. Computer Science, Information Technology, Artificial Intelligence &  
Bachelor Computer Application**

(For the candidates admitted from the academic year 2025 - 2026 onwards)

| Sem. | Course code | Credits | Title of the Course       | AC / AP / CC /<br>CP / DE / EVS /<br>GS / NME / SE /<br>VE / VAC | Category      |                  |              | Sem.<br>Exam | Max. Marks |     |        |
|------|-------------|---------|---------------------------|------------------------------------------------------------------|---------------|------------------|--------------|--------------|------------|-----|--------|
|      |             |         |                           |                                                                  | Theo.<br>Hrs. | Tutorial<br>Hrs. | Lab.<br>Hrs. |              | CIA        | ESE | Total. |
| II   | 25UMA2AP1   | 2       | Statistical Computing Lab | AC                                                               |               |                  | 2            | 3 Hrs.       | 40         | 60  | 100    |

**Pre-Requisite:**

**Course Objectives:** The purpose of learning this course is:

1. Understand the fundamentals of statistical concepts such as central tendency, dispersion, correlation, and data visualization
2. Develop proficiency in R programming for data analysis tasks
3. Apply graphical and numerical techniques to summarize, analyze, and interpret data.
4. Evaluate the relationship between data sets using statistical tools
5. Enhance problem-solving skills through hands-on scripting and plotting exercises

**Course Outcomes:**

CO1: Apply R functions to compute mean, median, mode, range, and standard deviation.

CO2: Generate bar charts, pie charts, and histograms to visualize datasets

CO3: Analyze relationships between variables using covariance and correlation

CO4: Interpret the distribution and variability of data using visual and numeric methods

CO5: Develop and test R scripts independently for solving statistical problems

**Develop a program using the R Program**

1. Write an R program to display the marks of 5 subjects using bar horizontal bar chart.
2. Given a set of marks in 4 subjects, write an R script to represent them as a pie chart and add appropriate Labels and a title.
3. Create an R script to draw a histogram with labelled axes, custom breaks, and coloured bars for test scores
4. Write an R program to calculate the mean of the following marks: 45, 56, 78, 88, and 92
5. Write an R program to find the median of the dataset: 56, 68, 72, 74, and 80.
6. Write an R program to find the mode of the values: 2, 4, 4, 6, 7, 4, and 8.
7. Write an R program to find the range of 45, 55, 60, 75, and 90.
8. Write an R program to compute the standard deviation of 10, 15, 20, 25, and 30.
9. Write an R program to calculate the covariance between  $X = c(1, 2, 3, 4, 5)$  and  $Y = c(2, 4, 6, 8, 10)$ .
10. Write an R program to calculate the correlation coefficient between  $x = c(1,2,3,4,5)$  and  $y = c(5,4,3,2,1)$ .

## B.Sc., PHYSICS & B. Sc., CHEMISTRY

(For the candidates admitted from the academic year 2025-26 onwards)

| Sem. | Course Code | Credits | Title of the Course             | AC/ AP / CC /<br>CP / DE / EVS/<br>GS / NME / SE /<br>VE / VAC | Category     |                  |              | Sem.<br>Exam | Max. Marks |     |        |
|------|-------------|---------|---------------------------------|----------------------------------------------------------------|--------------|------------------|--------------|--------------|------------|-----|--------|
|      |             |         |                                 |                                                                | Theo<br>Hrs. | Tutorial<br>Hrs. | Lab.<br>Hrs. |              | CIA        | ESE | Total. |
| I    | 25UMA1AC11  | 3       | <b>Algebra and Trigonometry</b> | AC                                                             | 5            |                  | -            | 3 Hrs.       | 25         | 75  | 100    |

### Pre-Requisite:

**Course Objectives:** The purpose of learning this course is:

1. To understand the concept of reciprocal equations and identify their standard forms.
2. To understand the Binomial Theorem, Exponential Series, and Logarithmic Series
3. To identify different types of series and techniques used for summing them.
4. To expand  $\cos(n\theta)$  and  $\sin(n\theta)$  using trigonometric identities.
5. To define and understand the basic hyperbolic functions ( $\sinh$ ,  $\cosh$ ,  $\tanh$ , etc.).

**Course Outcomes:** Students will be able to

CO1: Classify and Solve reciprocal equations.

CO2: Find the sum of Binomial, Exponential and Logarithmic series.

CO3: Find Inverse of Matrix, Eigen values, Eigen vectors and verify Cayley Hamilton theorem a given matrix.

CO4: Expand the powers and multiples of trigonometric functions in terms of sine and cosine.

CO5: Determine relationship between circular and hyperbolic functions.

### Unit-I Reciprocal Equations

9 Hrs.

Reciprocal Equations - Standard Form Reciprocal Equations – A reciprocal equation of the standard form can always be depressed to another of half the dimension - Increasing or decreasing the roots of a given equation by a given quantity - Removal of terms - Horner's method – related problems.

### Unit-II Binomial, Exponential & Logarithmic series:

9 Hrs.

**Binomial:** Application of the Binomial Theory to the summation of series.

**Exponential & Logarithmic series:** Summation - Series which can sum up by the logarithmic series - The application of the exponential and logarithmic series to limits and approximations (Theorems without proof) - Related Problems.

### Unit-III Summation of Series

9 Hrs.

Summation of Series: Applications of Partial fractions – The Product of successive terms – general term of reciprocal – sum to n terms of the series.

### Unit-IV Expansions of $\cos n\theta$ and $\sin n\theta$

9 Hrs.

Expansions of  $\cos n\theta$  and  $\sin n\theta$  – Expansion of  $\tan n\theta$  in powers of  $\tan\theta$  - Expansion of  $\tan(A+B+C \dots\dots)$  - Powers of sines and cosines of  $\theta$  in terms of functions of multiples of  $\theta$  - Expansion of  $\sin\theta \cos\theta$  and  $\tan\theta$  in a series ascending powers of  $\theta$  - Related problems.

### Unit-V Hyperbolic functions

9 Hrs.

Hyperbolic functions – Relation between circular and hyperbolic functions - Inverse hyperbolic functions.

**Text Books:**

1. T.K. Manicavasagom Pillai, S. Natarajan and Ganapathy, “Algebra” Volume – I 2006. (ISBN: 978-81-87156-17-8)
2. S. Narayanan, T.K. Manichavasagam Pillai, “Trigonometry”, S.Viswanathan (Printers & Publishers, Pvt Limited, 2010. (ISBN: 978-81-87156-16-1)
  - UNIT – I Chapter – 6 Section 16,16.1,17,19,30 of [1]
  - UNIT – II Chapter – 3 Section 10 of [1]
  - Chapter – 4 Section 3,9,11 of [1]
  - UNIT – III Chapter – 5 Section 1 to 5 of [1]
  - UNIT – IV Chapter – 3 Section 1 to 5 of [2]
  - UNIT – V Chapter – 4 Section 1 to 2 of [2]

**Reference Books:**

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005
2. C. V. Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003
3. J. Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012.

**Web Resources:**

1. <https://lib.alfaisal.edu/pdf/AlgebraAndTrigonometry-LR.pdf>
2. <https://home.cs.colorado.edu/~alko5368/lecturesCSCI2820/mathbook.pdf>
3. <https://www.gacwrmd.in/learning/Maths/Algebra%20and%20trigonometry%20Unit%20I%20to%20V.pdf>
4. [https://www.govst.edu/uploadedFiles/Academics/Colleges\\_and\\_Programs/CAS/Trigonometry\\_Short\\_Course\\_Tutorial\\_Lauren\\_Johnson.pdf](https://www.govst.edu/uploadedFiles/Academics/Colleges_and_Programs/CAS/Trigonometry_Short_Course_Tutorial_Lauren_Johnson.pdf)
5. <https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg%202023/ug%202021/Bsc%20mathematics%202023/JMMA11%20-%20I%20Sem%20-%20Algebra%20&%20Trigonometry.pdf>

| Course Outcomes (COs)             | Program Outcomes (POs) |     |     |     |     |     |     |     | Programme Specific Outcomes (PSOs)    |      |      |      |      |
|-----------------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|------|------|------|------|
|                                   | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1                                  | PSO2 | PSO3 | PSO4 | PSO5 |
| <b>CO1</b>                        | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 1   | 3                                     | 3    | 1    | 1    | 3    |
| <b>CO2</b>                        | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 1   | 3                                     | 3    | 2    | 1    | 3    |
| <b>CO3</b>                        | 3                      | 3   | 3   | 2   | 2   | 1   | 3   | 3   | 3                                     | 3    | 3    | 1    | 3    |
| <b>CO4</b>                        | 3                      | 3   | 2   | 1   | 1   | 1   | 2   | 1   | 3                                     | 3    | 1    | 1    | 3    |
| <b>CO5</b>                        | 3                      | 3   | 2   | 1   | 1   | 1   | 2   | 1   | 3                                     | 3    | 1    | 2    | 3    |
| <b>Total</b>                      | 15                     | 15  | 13  | 6   | 8   | 5   | 11  | 7   | 15                                    | 15   | 8    | 6    | 15   |
| Overall CO – PO Mapping index = 2 |                        |     |     |     |     |     |     |     | Overall CO – PSO Mapping index = 2.36 |      |      |      |      |

1 – Low Correlation

2 – Medium Correlation

3 – High Correlation

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## B.Sc., PHYSICS & B. Sc., CHEMISTRY

(For the candidates admitted from the academic year 2025-26 onwards)

| Sem. | Course Code | Credits | Title of the Course                    | AC/ AP / CC / CP / DE / EVS/ GS / NME /SE / VE / VAC | Category  |               |           | Sem. Exam | Max. Marks |     |        |
|------|-------------|---------|----------------------------------------|------------------------------------------------------|-----------|---------------|-----------|-----------|------------|-----|--------|
|      |             |         |                                        |                                                      | Theo Hrs. | Tutorial Hrs. | Lab. Hrs. |           | CIA        | ESE | Total. |
| II   | 25UMA2AC21  | 3       | <b>ODE, PDE AND LAPLACE TRANSFORMS</b> | AC                                                   | 4         | 1             | -         | 3 Hrs.    | 25         | 75  | 100    |

### Pre-Requisite:

**Course Objectives:** The purpose of learning this course is:

1. To Understand and solve first-order linear differential equations.
2. Learn how to form partial differential equations (PDEs) by eliminating arbitrary constants and functions.
3. Use Laplace Transforms to evaluate definite integrals.
4. Solve problems involving inverse transforms in applied contexts.
5. Use Laplace Transforms to solve ordinary differential equations (ODEs) with constant coefficients.

**Course Outcomes:** Students will be able to

CO1: Equations solvable for  $dy/dx$ ,  $x$  and  $y$ .

CO2: Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.

CO3: Understand Laplace transforms and discuss the Properties of Laplace transforms

CO4: Define and illustrate the inverse Laplace transforms.

CO5: Discuss the Application of Laplace transforms.

### Unit-I Ordinary Differential Equations

9 Hrs.

Linear Equations - Bernoulli's equation-First order higher degree equations-solvable for  $x$ ,  $y$ ,  $p$  -clairaut's form.

### Unit-II Partial Differential Equations

9 Hrs.

Formation of equations by elimination of arbitrary constants and function -Definition of general, particular and complete solutions- solving standard forms

(i)  $f(p,q) = 0$  (ii)  $f(x,p,q) = 0$ ,  $f(y,p,q) = 0$ ,  $f(z, p,q)=0$

- Lagrange's Differential equations  $Pp+Qq = R$ - Charpit's Method.

### Unit-III Laplace Transforms

9 Hrs.

Sufficient condition for the existence of the Laplace Transforms –Properties of Laplace Transforms – Laplace Transform of periodic functions – Some general Theorems - Evaluation of Integrals.

### Unit-IV Laplace Transforms (Continued)

9 Hrs.

Inverse Laplace Transforms- Inverse Transforms of functions– Related problems.

### Unit-V Laplace Transforms (Continued)

9 Hrs.

Application of Laplace Transforms-Solution of ODE with constant coefficients –Solution of Systems of Differential Equations - Solution of differential Equations with variable coefficients.

**Text Books:**

- S. Narayanan and T. K. Manicavachagam Pillai, Differential Equations and its Applications, S. Viswanathan Publishers Pvt. Ltd., 2011. (ISBN: 9788187156048)
 

|            |              |                  |
|------------|--------------|------------------|
| UNIT – I   | Chapter – 4  | Sections 1 to 3  |
| UNIT – II  | Chapter – 12 | Sections 1 to 6  |
| UNIT – III | Chapter – 9  | Sections 1 to 5  |
| UNIT – IV  | Chapter – 9  | Sections 6 & 7   |
| UNIT – V   | Chapter – 9  | Sections 8 to 10 |

**Reference Books:**

- M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co. 2010.
- Murray R. Spiegel, Schaum's Outline of Theory and Problems of Laplace Transforms, McGraw Hill, 1965

**Web Resources:**

- [https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/3/UG\\_B.Sc. Mathematics 11333-Differential%20Equations%20&%20its%20Applications%20.pdf](https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/3/UG_B.Sc. Mathematics 11333-Differential%20Equations%20&%20its%20Applications%20.pdf)
- <https://sciences.uodiyala.edu.iq/wp-content/uploads/2023/09/1-MAT-102UNIT12.pdf>
- [https://www.mmmut.ac.in/News\\_content/43114dep-notice\\_04262020.pdf](https://www.mmmut.ac.in/News_content/43114dep-notice_04262020.pdf)
- [https://www.hansrajcollege.ac.in/hCPannel/uploads/elearning/elearning\\_document/Laplace2\\_H RC.pdf](https://www.hansrajcollege.ac.in/hCPannel/uploads/elearning/elearning_document/Laplace2_H RC.pdf)
- [https://pages.jh.edu/mzhong5/courses/EN\\_560\\_601\\_S17/homeworks/560\\_601\\_HW8.pdf](https://pages.jh.edu/mzhong5/courses/EN_560_601_S17/homeworks/560_601_HW8.pdf)

| Course Outcomes (COs)                 | Program Outcomes (POs) |     |     |     |     |     |     |     | Programme Specific Outcomes (PSOs)    |      |      |      |      |
|---------------------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|------|------|------|------|
|                                       | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1                                  | PSO2 | PSO3 | PSO4 | PSO5 |
| <b>CO1</b>                            | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 1   | 3                                     | 3    | 2    | 1    | 3    |
| <b>CO2</b>                            | 3                      | 3   | 3   | 1   | 2   | 1   | 2   | 1   | 3                                     | 3    | 2    | 1    | 3    |
| <b>CO3</b>                            | 3                      | 3   | 3   | 1   | 2   | 1   | 3   | 3   | 3                                     | 3    | 3    | 1    | 3    |
| <b>CO4</b>                            | 3                      | 3   | 3   | 1   | 2   | 1   | 3   | 3   | 3                                     | 3    | 3    | 2    | 3    |
| <b>CO5</b>                            | 3                      | 3   | 3   | 2   | 2   | 2   | 3   | 3   | 3                                     | 3    | 3    | 3    | 3    |
| <b>Total</b>                          | 15                     | 15  | 15  | 6   | 10  | 6   | 13  | 11  | 15                                    | 15   | 13   | 8    | 15   |
| Overall CO – PO Mapping index = 2.275 |                        |     |     |     |     |     |     |     | Overall CO – PSO Mapping index = 2.64 |      |      |      |      |

1 – Low Correlation

2 – Medium Correlation

3 – High Correlation

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HoD

## B.Sc., PHYSICS & B. Sc., CHEMISTRY

(For the candidates admitted from the academic year 2025-26 onwards)

| Sem. | Course Code | Credits | Title of the Course                            | AC/ AP / CC / CP / DE / EVS/ GS / NME / SE / VE / VAC | Category  |               |           | Sem. Exam     | Max. Marks |           |            |
|------|-------------|---------|------------------------------------------------|-------------------------------------------------------|-----------|---------------|-----------|---------------|------------|-----------|------------|
|      |             |         |                                                |                                                       | Theo Hrs. | Tutorial Hrs. | Lab. Hrs. |               | CIA        | ESE       | Total.     |
| II   | 25UMA2AC31  | 3       | <b>Analytical Geometry of Three Dimensions</b> | CC                                                    | 4         |               |           | <b>3 Hrs.</b> | <b>25</b>  | <b>75</b> | <b>100</b> |

**Pre-Requisite:**

**Course Objectives:** The purpose of learning this course is:

1. To compute the distance between two points in 3D geometry.
2. To derive the equation of a plane through the line of intersection of two given planes.
3. To derive and apply the symmetrical form of a line's equation.
4. To understand and derive the standard and general equations of a sphere.
5. To study and derive the general equation of a quadric surface.

Course Outcomes: Students will be able to

CO1: Compute distances, angles, and projections between points and lines using Cartesian coordinates.

CO2: Calculate angles between planes and determine the length of perpendiculars from points to planes.

CO3: Analyze the spatial relationships between lines and planes, including angle, coplanarity, intersection, and shortest distance.

CO4: Determine plane sections, circles on spheres, and tangent planes.

CO5: Understand and derive equations for central quadric surfaces including cones and cylinders.

**Unit-I Rectangular Cartesian co-ordinates Direction cosines of a line** 9 Hrs.

Coordinates – Distance between two points - Angle between two lines – Projections-Direction Cosines-Direction Ratios-Conditions for perpendicularity and parallelism.

**Unit-II The Planes** 9 Hrs.

System of Planes – Direction cosines of the lines which is perpendicular to a plane – Angle between the planes – Equation of a plane through the line of intersection of two given planes - Length of the perpendicular.

**Unit-III The Straight Lines** 9 Hrs.

A straight line may be determined as the intersection of two planes – Symmetrical form of the equations of a line – Equation of a straight line passing through two given points.

**The plane and the straight line:** Angle between the line and the plane – Coplanar lines – shortest distance between two given lines –The intersection of three planes.

**Unit-IV The Sphere** 9 Hrs.

Equation of a sphere –The general equation – The plane section of a sphere is a circle - Equation of the circle on a sphere –The equation of a tangent plane.

**Unit-V The Central Quadrics and Cone** 9 Hrs.

The equation of a surface -Cone - Right circular cone - Intersection of a straight line and a quadric cone - Tangent plane and normal - Condition that the cone has three mutually perpendicular generators - Cylinder - Enveloping Cylinder.

**Text Books:**

- T.K. Manickavachagom Pillai and T. Natarajan. A Text Book of Analytical Geometry (Part II-Three Dimensions) Viswanathan (Printers & Publishers) Pvt. Ltd.(ISBN: 9788187156031)
 

|          |             |                 |
|----------|-------------|-----------------|
| Unit I   | Chapter – 1 | Sec 1 to 12     |
| Unit II  | Chapter – 2 | Sec 1 to 11     |
| Unit III | Chapter – 3 | Sec 1 to 8 & 10 |
| Unit IV  | Chapter – 4 | Sec 1 to 8      |
| Unit V   | Chapter – 5 | Sec 1 to 8      |

**Reference Books:**

- S. L. Loney, Co-ordinate Geometry.
- Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions.
- William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016.
- Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9<sup>th</sup> Edition, 2010.
- Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961.
- Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, Cengage Learning, CA, USA, 2010.
- William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc, New York, 2006.

**Web Resources:**

- <https://ia800504.us.archive.org/11/items/elementsofcoordi00lone/elementsofcoordi00lone.pdf>
- [https://www.forgottenbooks.com/en/download/An\\_Elementary\\_Treatise\\_on\\_Coordinate\\_Geometry\\_of\\_Three\\_Dimensions\\_1000038010.pdf](https://www.forgottenbooks.com/en/download/An_Elementary_Treatise_on_Coordinate_Geometry_of_Three_Dimensions_1000038010.pdf)
- <https://nptel.ac.in>
- [https://oms.bdu.ac.in/ec-colleges/admin/contents/175\\_16SACMM2\\_2020051905134587.pdf](https://oms.bdu.ac.in/ec-colleges/admin/contents/175_16SACMM2_2020051905134587.pdf)
- [https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg/ug/bsc\\_maths/JSMA22\\_II\\_Sem\\_LaTeX.pdf](https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg/ug/bsc_maths/JSMA22_II_Sem_LaTeX.pdf)

| Course Outcomes (COs)               | Program Outcomes (POs) |     |     |     |     |     |     |     | Programme Specific Outcomes (PSOs)    |      |      |      |      |
|-------------------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|---------------------------------------|------|------|------|------|
|                                     | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1                                  | PSO2 | PSO3 | PSO4 | PSO5 |
| <b>CO1</b>                          | 3                      | 3   | 2   |     | 1   |     | 1   |     | 3                                     | 2    | 2    | 1    | 2    |
| <b>CO2</b>                          | 3                      | 3   | 2   |     | 1   |     | 1   |     | 3                                     | 2    | 2    | 1    | 2    |
| <b>CO3</b>                          | 3                      | 3   | 2   | 1   | 1   | 1   | 2   | 1   | 3                                     | 3    | 2    | 2    | 3    |
| <b>CO4</b>                          | 3                      | 2   | 2   |     | 1   |     | 1   |     | 3                                     | 2    | 2    | 2    | 3    |
| <b>CO5</b>                          | 3                      | 3   | 2   | 1   | 1   | 1   | 2   | 2   | 3                                     | 2    | 2    | 2    | 3    |
| <b>Total</b>                        | 15                     | 14  | 12  | 4   | 8   | 6   | 9   | 4   | 15                                    | 11   | 10   | 8    | 13   |
| Overall CO – PO Mapping index = 1.8 |                        |     |     |     |     |     |     |     | Overall CO – PSO Mapping index = 2.28 |      |      |      |      |

1 – Low Correlation

2 – Medium Correlation

3 – High Correlation

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