THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

B.Sc. MATHEMATICS - 2022-2023 onwards

Programme Objectives:

1. Students should acquire the knowledge of basic mathematical concepts and the ability to communicate mathematical ideas with clarity and coherence.

2. Students should have the ability to solve problems in Mathematics independently by applying logical reasoning, abstraction, and critical analysis, and they have to know how to apply relevant mathematical techniques.

3. Competence in using computational tools and software such as Excel, Graphics, algorithms, and programs.

4. Students should possess a basic fundamental knowledge in Mathematics which is required for higher studies in pure, applied Mathematics and other professional courses.

5. To develop the attitude and ability to apply mathematical methods and ideas in other sciences and engineering programmes.

Programme Educational Objectives:

1. To acquire basic domain knowledge in mathematical concepts and their applications.
2. To develop analytical thinking, and logical reasoning skills to solve mathematical problems.
3. The ability to formulate real-life problems, applying appropriate mathematical models/tools to solve such problems.
4. Acquire the knowledge of applying mathematical techniques in other branches.
5. Students will develop the qualities such as working individually as well as the ability to work in teams.

Programme Specific Outcomes:

1. Represent the mathematical data in numerical, graphical, and visual form.
2. Develop the patience and persistence to solve a problem.
3. Students will have the knowledge to use ICT tools.
4. Motivation to the students to do research in the unexplored areas of Mathematics.
5. Ability to apply mathematical techniques in other fields of science and engineering.
6. Select appropriate algorithms and software programs to obtain accurate solutions to mathematical problems.
7. Students will be able to develop a solution oriented approach toward various social and environmental issues.
8. Gaining knowledge to pursue higher studies in pure and applied Mathematics.

9. Understand, formulate and apply quantitative models in management, economics, and business contexts.
10. Ignites their passion to do research in Mathematics.

Programme Outcomes:

1. Logical thinking, critical analysis, and reasoning skills will be highly improved.
2. Express mathematical ideas clearly and concisely to others.
3. Ability to apply suitable mathematical techniques to handle problems in physical and related sciences.
4. To demonstrate conceptual understanding of basic definitions, and theorems in Mathematics and should be able to describe elaborately with examples.
5. Ability to solve mathematical problems by applying the skills such as critical thinking, logical reasoning, and abstraction.
6. Select appropriate mathematical models and tools to solve the problems including those in real-life contexts.
7. Mathematics has its own universal language of symbols and notations. Students are expected to apply the Mathematics language appropriately while expressing mathematical ideas in both oral and written form.
8. Problem-solving techniques in mathematics will enhance the knowledge of students to formulate and solve any real-world problems independently.
9. Develop the knowledge of abstract mathematical concepts.
10. Enhance the employability skills in both public and private sector jobs

THIRUVALLUVAR UNIVERSITY
BACHELOR OF SCIENCE
B.Sc. MATHEMATICS DEGREE COURSE
(With effect from 2022 - 2023)
The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components / Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	Communicative English I	25	75	100
3.	III	Core Theory	Paper-1	5	3	Algebra	25	75	100
4.	III	Core Theory	Paper-2	5	3	Trigonometry	25	75	100
5.	III	Allied -1	Paper-1	4	3	(to choose any 1 out of 4)	25	75	100
	III	Allied- 1	Practical-1	2	0	(For Practical Allied subjects)	0	0	0
6.	III	PE	Paper 1	6	3	Professional English I	25	75	100
7.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		36	22		175	525	700
		SEMESTER II					CIA	Uni. Exam	Total
8.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9.	II	English (CE)	Paper-2	4	4	Communicative English II	25	75	100
10.	**II**	**NMSDC I : Language Proficiency for Employability**	**Paper-1**	**2**	**2**	**Effective English**	**25**	**75**	**100**
11.	III	Core Theory	Paper-3	4	3	Calculus	25	75	100
12.	III	Core Theory	Paper-4	4	3	Analytical Geometry of three dimensions	25	75	100
13.	III	Allied-1	Paper-2	4	3	(to choose any 1 out of 4) (For Practical Allied subjects)	25	75	100
14.	III	Allied Practical – 1	Practical-1	2	2	(to choose any 1 out of 4) (For Practical Allied subjects)	25	75	100
15.	III	PE	Paper 1	6	3	Professional English II	25	75	100
16.	IV	Value Education		2	2		25	75	100
17.	IV	Soft Skill		2	1		25	75	100
		Sem. Total		36	27		250	750	1000
		SEMESTER III							
18.	I	Language	Paper-3	6	4	Tamil / Other Languages	25	75	100
19.	II	English	Paper-3	6	4	English	25	75	100
20.	III	Core Theory	Paper-5	6	5	Differential Equations and Laplace Transforms	25	75	100
21.	III	Allied-2	Paper-3	4	3	(to choose any 1 out of 4) (For Practical Allied subjects)	25	75	100
	III	Allied Practical – 2	Practical-2	3	0		0	0	0
22.	IV	Skill Based Subject	Paper-1	3	2	Mathematics for competitive Examinations – I	25	75	100
23.	IV	Non-Major Elective	Paper-1	2	2	Basic Mathematics	25	75	100
		Sem. Total		30	20		150	450	600

SEMESTER IV									
24.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
25.	II	English	Paper-4	4	4	English	25	75	100
25.	III	Core Theory	Paper-6	4	4	Vector Analysis and Fourier Series	25	75	100
26.	III	Core Theory	Paper-7	5	4	Statics	25	75	100
27.	III	Allied-2	Paper-4	4	3	(to choose any 1 out of 4) (For Practical Allied subjects)	25	75	100
28	III	Allied Practical – 2	Practical-2	3	2		25	75	100
29.	**IV**	**NMSDC II : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	**25**	**75**	**100**
30.	IV	Non-Major Elective	Paper-2	2	2	Foundation Mathematics for Competitive Examinations – I	25	75	100
		Sem. Total		30	25		200	600	800
SEMESTER V									
31.	III	Core Theory	Paper-8	6	4	Abstract Algebra	25	75	100
32.	III	Core Theory	Paper-9	6	4	Real Analysis – I	25	75	100
33.	III	Core Theory	Paper-10	6	4	Dynamics	25	75	100
34.	IV	Elective	Paper-1	5	3	(to choose any 1 out of 2) 1. Linear Programming 2. Special Functions	25	75	100
35.	IV	Elective	Paper-2	4	3	(to choose any 1 out of 2) 1.Graph Theory 2. Discrete Mathematics	25	75	100
36.	IV	Skill Based Subject	Paper-3	3	2	Mathematics for Competitive Examinations – III	25	75	100
		Sem. Total		30	20		150	450	600
SEMESTER VI									
37.	III	Core Theory	Paper-11	5	4	Linear Algebra	25	75	100
38	III	Core Theory	Paper-12	5	4	Real Analysis II	25	75	100
39.	III	Core Theory	Paper-13	5	4	Complex Analysis	25	75	100
40.	III	Compulsory Project	Project-1	3	5	Group / Individual Project	25	75	100
41.	III	Core Theory	Paper-14	3	3	Programming in C Language	25	75	100
42.	III	Core Practical	Practical-1	3	2	C Language	25	75	100
43.	IV	Elective	Paper-3	3	3	(to choose any 1 out of 3) 1. Operations Research 2. Fuzzy Mathematics 3. R Programming (Practical Only)	25	75	100
44.	**III**	**NMSDC III : Data Analytics with Advanced Tools for Employability**	**Paper – 3**	**2**	**2**	**Project based learning III**	**25**	**75**	**100**
45.	V	Extension Activities		0	1		100	0	100
		Sem. Total		30	28		300	600	900
		Grand Total			142				4500

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: I **Paper type: Core**

Paper code: C - 01 **Name of the Paper: PAPER – 1 – ALGEBRA** **Credit: 3**Total

Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. Students are exposed to solving polynomial equations, summation of an infinite series, matrices, and elementary number theory.
2. To learn the different methods to solve polynomial equations.
3. To understand the methods of the sum to infinity of a binomial, exponential, and logarithmic series.
4. To find the Eigen values and Eigen vectors of a given square matrix.
5. To acquire a basic knowledge of different types of numbers, a number of divisors of a positive integer.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate the knowledge of the relationship between roots and coefficients of the given equation.
2. After studied unit -2, the student will be able to carry out the calculations of approximate roots of the given polynomial equation.
3. After studied unit -3, the student will be able to find the sum to infinity of the given binomial/exponential/logarithmic series.
4. After studied unit -4, the student will be able to demonstrate the knowledge of matrices and calculate the Eigen values and Eigen vectors of a given square matrix.
5. After studied unit -5, the student will be able to discuss the basic number theory concepts.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT-I: THEORY OF EQUATIONS

Polynomial Equations – Relation between roots and coefficients - Symmetric Functions of roots in terms of Coefficients - Transformation of Equations - Reciprocal Equations.

UNIT-II: THEORY OF EQUATIONS (Contd...)

Descartes Rule of Signs - Approximate Solutions of Polynomials by Horner's method - Newton - Raphson method of Solving a Cubic Polynomial.

UNIT-III: SUMMATION OF SERIES

Summation of series using Binomial - Exponential and Logarithmic series (Theorems without proofs) - Approximation using Binomial, Exponential and Logarithmic series - simple problems.

UNIT-IV: MATRICES

Symmetric - Skew Symmetric, - Hermitian - Skew Hermitian - Orthogonal and Unitary Matrices - Eigen Values - Eigen Vectors – Cayley-Hamilton Theorem (without proof) - Similar Matrices - Diagonalisation of a Matrix.

UNIT-V: ELEMENTARY NUMBER THEORY

Prime Number - Composite Number - Decomposition of a Composite Number as a Product of Primes uniquely (without proof) - Divisors of a Positive Integer - Congruence Modulo *n* - Euler Function (without Proof) - Highest Power of a Prime Number p contained in *n!*- Fermat's and Wilson's Theorems (statements only) - simple problems.

Text book:

T.K.Manicavachagom Pillay, T.Natarajan and K.S.Ganapathy, *Algebra,* Volume I (2007) & II (2008) S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books:

1. P.Kandasamy, K.Thilagavathy (2004), Mathematics for B.Sc. Vol-I, II, III & IV, S.Chand& Company Ltd., New Delhi-55.
2. S.Arumugam (2003) *Algebra*. New Gamma Publishing House, Palayamkottai.
3. P.R.Vittal, V.Malini, *Algebra and Trigonometry*, Margham Publications, Chennai.
4. S.Sudha(1998) *Algebra and Trigonometry,* Emerald Publishers, Chennai.

Course Material: website links, e-Books and e-journals
https://tutorial.math.lamar.edu/Classes/Alg/Alg.aspx
https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx
https://ocw.mit.edu/courses/18-701-algebra-i-fall-2010/
https://ocw.mit.edu/courses/18-785-number-theory-i-fall-2021/
https://www.classcentral.com/course/algebra-i-44578
https://www.classcentral.com/course/polynomials-roots-44577

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	S	M	M	M
CO2	M	M	S	M	M	S	S	S	M	S
CO3	S	S	S	M	M	M	M	M	M	M
CO4	S	M	S	S	M	S	S	M	M	M
CO5	M	M	M	S	S	S	M	S	M	S

PO – Programme Outcome CO – Course outcome

S – Strong M-Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: I **Paper type: Core**

Paper code: C - 02 **Name of the Paper: PAPER – 2 – TRIGONOMETRY** **Credit: 3**
Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. This course is designed for the students to expose the topics such as expansions of trigonometric functions, hyperbolic functions, inverse circular, and inverse hyperbolic functions.
2. To gain the knowledge of expansions of cosnθ and sinnθ in powers of cosθ and sinθ.
3. To acquire the knowledge of hyperbolic and inverse hyperbolic functions.
4. Basic knowledge about the Logarithm of complex quantities.
5. To understand and carry out the calculations of summation of trigonometric series.

Course Outcomes

1. After studied unit -1, the student will be able to write the expansions of cosnθ and sinnθ in powers of cosθ and sinθ.
2. After studied unit -2, the student will be able to expand the powers of sines and cosines of θ in terms of functions of multiples of θ.
3. After studied unit -3, the student will be able to discuss the concepts of hyperbolic functions.
4. After studied unit -4, the student will be able to demonstrate knowledge of the logarithm of complex quantities.
5. After studied unit -5, the student will be able to carry out the calculations of summation of trigonometric series.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	No	Yes	Yes
5	No	Yes	Yes	Yes	Yes	No

UNIT-I

Expansions of cosnθ, sinnθ in powers of cosθ and sinθ - Expansion of tannθ in powers of tan θ - Expansion of tan(A+B+C+…) - Formation of Equations.
Chapter III Sections 1 to 3

UNIT-II

Powers of sines and cosines of θ in terms of functions of multiples of θ - Expansions of sinθ, cosθ and tanθ in a series of ascending powers of θ –Approximation problems -

Expansions of Inverse Circular Functions.
Chapter III Sections 4 and 5

UNIT-III:

Hyperbolic Functions: Definition – Relation between Hyperbolic and Circular Functions - Inverse Hyperbolic Functions.
Chapter IV Sections 1 to 2.3

UNIT-IV

Resolution into Factors - Simple problems only - DeMoivre's Property on the Circle and Cote's Property on the Circle - Logarithm of complex quantities.
Chapter V Sections 2 and 3(Problems only) 4, 4.1, 4.2, 5, 5.1, 5.2.

UNIT-V

Summation of Trigonometric Series: Method of Differences - Angles are in A.P, C+iS method of summation - Gregory Series - Euler Series.
Chapter VI Sections 1, 2 ,3 ,3.1, 3.2.

Text book:

1. S.Narayanan and T.K. Manicavachagom Pillay (2004) *Trigonometry.*S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books:

1. P.Kandasamy, K.Thilagavathy (2004), Mathematics for B.Sc. Vol.-I, II, III & IV, S.Chand & Company Ltd., New Delhi-55.
2. S.Duraipandian and LaxmiDuraipandian (1984) *Trigonometry*. Emerald Publishers, Chennai.
3. B.S.Grewal. (2002) *Higher Engineering Mathematics.* Khanna Publishers. New Delhi.
4. S.L.Loney. (1982) *Plane Trigonometry,* Part II*,* Cambridge University Press, London.
5. A.Singaravelu (2003) *Algebra and Trigonometry*, Vol-I Meenakshi Agency, Chennai.
6. P.R.Vittal. (2004) *Trigonometry*, Margham Publications, Chennai.

Course Material: website links, e-Books and e-journals

https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx
https://www.coursera.org/lecture/fe-exam/analytic-geometry-and-trigonometry-straight-lines-SV8UL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=top_button
https://www.engineering.iastate.edu/student-services/orientation/math-142-trigonometry-analytical-geometry/

Mapping with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	M	M	M	M
CO2	M	M	M	S	S	S	M	S	S	M
CO3	S	S	S	S	M	M	S	S	M	S
CO4	M	S	S	S	S	M	M	M	M	M
CO5	S	S	S	M	M	M	M	M	M	M

PO – Programme Outcome CO – Course outcome

S – Strong M-Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: II **Paper type: Core**

Paper code: C - 03 **Name of the Paper: PAPER – 3 – CALCULUS** **Credit: 3**

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. This course introduces the basic concepts of differential and integral calculus.
2. To know about the angle between two curves and the radius of curvature.
3. To inculcate a strong knowledge about evolutes and envelopes.
4. Knowledge about reduction formulae and properties of definite integrals.
5. To acquire the knowledge about evaluation of double and triple integrals.

Course Outcomes

1. After studied unit -1, the student will be able to determine the extreme values of the given function.
2. After studied unit -2, the student will be able to demonstrate knowledge of Cartesian and polar coordinates.
3. After studied unit -3, the student will be able to gain knowledge of curvature, evolutes, and envelope concepts.
4. After studied unit -4, the student will be able to evaluate definite integration problems and able to apply reduction formulae.
5. After studied unit -5, the student will be able to evaluate double and triple integrals.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	No	Yes	Yes	Yes	Yes	No
3	No	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT-I: Differential Calculus

n^{th} derivative - Leibnitz's theorem (Without proof) and its application - Jacobians - Total differential - Maxima and Minima functions of two and three independent variables - Lagrange's method (without proof) - Simple problems.

UNIT-II: Differential Calculus (Contd…)

Polar coordinates – Relation between Cartesian and Polar coordinates - Polar Equation of a Straight line, Circle and Conic only (Related problems not necessary) - Angle between radius vector and tangent – Angle between two curves – Curvature - Radius of Curvature in Cartesian and Polar coordinates.

UNIT-III: Differential Calculus (Contd…)

Centre of Curvature – Evolutes – Envelopes – Asymptotes – Methods of finding asymptotes (Rational algebraic curves only).

UNIT-IV: Integral Calculus

Reduction formula for $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sin^m x \cos^n x$ - Beta and Gamma Functions - Properties and Problems – Definite Integral – Properties - Simple Problems.

UNIT-V: Integral Calculus (Contd…)

Double Integrals - Change of order of Integration - Triple Integrals - Applications to Area, Surface Area and Volume.

Text book:

S.Narayanan and T.K.Manicavachagom Pillay (2004) *Calculus.*S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books:

1. P.Kandasamy, K.Thilagavathy (2004), Mathematic for B.Sc. Vol.-I, II, III & IV, S.Chand& Company Ltd., New Delhi-55.
2. Shanti Narayan (2001) *Differential Calculus*. Shyamlal Charitable Trust, New Delhi.
3. Shanti Narayan (2001) *Integral Calculus.*S.Chand& Co. New Delhi.
4. S.Sudha (1998) *Calculus.* Emerald Publishers, Chennai.
5. G.B.Thomas and R.L.Finney. (1998) *Calculus and Analytic Geometry*, Addison Wesley (9^{th}Edn.), Mass. (Indian Print)
6. P.R.Vittal. (2004) *Calculus*, Margham Publication, Chennai.

Course Material: website links, e-Books and e-journals

https://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx
https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx
https://mathworld.wolfram.com/topics/CalculusandAnalysis.html
https://www.liberty.edu/online/courses/math131/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	M	S	M	S
CO2	M	S	S	S	S	S	M	M	S	M
CO3	M	M	M	S	S	S	S	S	M	M
CO4	M	S	S	S	S	S	S	S	M	S
CO5	S	M	M	S	M	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: II **Paper type: Core**

Paper code: C - 04 **Name of the Paper: PAPER – 4 – ANALYTICAL GEOMETRY OF THREE DIMENSIONS** **Credit: 3**

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. This course is designed to deepen the knowledge of the students in various fundamental concepts of analytical solid geometry.
2. Knowledge about the symmetrical form of a straight line and the shortest distance between two skew lines.
3. To acquire the basic knowledge of a sphere, section of a sphere by a plane.
4. To demonstrate knowledge of the different types of cones and related problems.
5. To inculcate the study about different types of cylinders.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate knowledge of the plane and its applications.
2. After studied unit -2, the student will be able to gain knowledge of straight lines and their applications.
3. After studied unit -3, the student will be able to carry out sphere-related problems.
4. After studied unit -4, the student will be able to know the concepts of the cone, right circular cone, and enveloping cone.
5. After studied unit -5, the student will be able to carry out the calculations of the problems related to the cylinder.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	Yes	Yes	No	Yes	No
2	No	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	No	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

Unit I: Plane

General equation of a plane – Equation of a plane in the normal form – Angle between planes – Plane through three given points – Equation of a plane through the line of intersection of two planes.

UNIT II: Straight Line

Symmetrical form of a straight line – Image of a point with respect to a plane – Image of a line with respect to a plane – Length and equation of the shortest distance between two skew lines - Coplanar lines.

UNIT III: Sphere

Equation of the sphere – Length of the tangent – Tangent plane – Section of a sphere by a plane – Orthogonal spheres – Equation of a sphere through a given circle.

UNIT IV: Cone

Equation of a cone with a given vertex and a given guiding curve - Equation of a cone with its vertex at the origin - Condition for the general equation of the second degree to represent a cone - Right circular cone – Enveloping cone - Tangency of a plane to a cone.

UNIT V: Cylinder

Equation of a cylinder with a given generator and a given guiding curve - Right circular cylinder - Enveloping cylinder – Enveloping cylinder as a limiting form of an enveloping cone.

Text book:

T.K.Manickavachagom Pillay & others. (2004) *Analytical Geometry* (Three Dimensions) S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.

Reference Books:

1. P.Duraipandian and LaxmiDuraipandian (1965) *Analytical Geometry-2D,* Asia Publishing company, Bombay
2. P.Duraipandian and LaxmiDuriapandian (1975) *Analytical Geometry-3 D*, Emerald Publishers, Chennai.
3. G.B.Thomas and R.L.Finney.(1998) *Calculus and Analytic Geometr*y, Addison Wesley (9^{th}Edn.), Mass. (Indian Print).
4. P.R.Vittal (2003) *Coordinate Geometry.* Margham Publishers, Chennai

Course Material: website links, e-Books and e-journals

https://www.coursera.org/lecture/fe-exam/analytic-geometry-and-trigonometry-straight-lines-SV8UL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=top_button
https://www.khanacademy.org/math/geometry-home/analytic-geometry-topic
https://www.liberty.edu/online/courses/math131/
https://www.engineering.iastate.edu/student-services/orientation/math-142-trigonometry-analytical-geometry/
https://www.hackmath.net/en/word-math-problems/analytic-geometry
https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	S	S	S	M
CO2	M	M	M	S	S	S	S	S	M	M
CO3	M	M	M	S	S	S	S	S	S	S
CO4	S	S	S	S	M	M	M	M	S	S
CO5	S	M	M	M	M	M	M	M	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: III **Paper type: Core**

Paper code: C – 05 Name of the Paper: PAPER – 5 – DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORM **Credit: 5**

Total Hours per Week: 6 Lecture Hours: 6 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To provide logical skills in the formation of differential equations.
2. To expose different techniques for finding solutions to differential equations.
3. To understand the topics of simultaneous and total differential equations.
4. To acquire a strong knowledge about Laplace and inverse Laplace transforms.
5. Knowledge about solving partial differential equations.

Course Outcomes

1. After studied unit -1, the student will be able to know the various methods of solving the first-order higher degree differential equations.
2. After studied unit -2, the student will be able to carry out the different methods of solving the second order differential equations.
3. After studied unit -3, the student will be able to understand the concepts of total differential equations and solve the problems.
4. After studied unit -4, the student will be able to demonstrate knowledge of Laplace transform and its applications.
5. After studied unit -5, the student will be able to solve partial differential equations.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	No	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	No	Yes	Yes

UNIT-I: Ordinary Linear Differential Equations

Bernoulli Equation – Exact Differential Equations – Equations Reducible to Exact Equations – Equations of First order and Higher degree: Equations solvable for p, Equations solvable for x and Equations Solvable for y – Clairaut's Equation.

UNIT-II: Ordinary Linear Differential Equations [Contd...]

Method of Variation of Parameters – 2^{nd} order Differential Equations with Constant Coefficients for finding the P.I's of the form e^{ax} V, where V is sin(mx) or cos(mx) or x^n – Equations reducible to Linear equations with constant coefficients – Cauchy's homogeneous Linear Equations – Legendre's Linear Equations.

UNIT-III: Differential Equations of Other Types

Simultaneous Equations with Constant coefficients – Total Differential Equations Simultaneous Total Differential Equations – Equations of the form dx/P = dy/Q = dz/R

UNIT-IV: Laplace Transform

Transform-Inverse Transform – Properties – Application of Laplace Transform to solution of first and second order Linear Differential equations [with constant coefficients].

UNIT-V: Partial Differential Equations

Formation of PDF – Complete Integral – Particular Integral – Singular Integral – Equations Solvable by direct Integration – Linear Equations of the first order – Non-linear Equations of the first Order:
Types: $f(p,q) = 0$, $f(x,p,q) = 0$, $f(y, p, q) = 0$, $f(z, p, q) = 0$, $f(x, q) = f(y, p)$,
$z = px+qy + f(p, q)$.

Text book:
S.Narayanan and T.K.Manicavachagom Pillay[2004] , Calculus, S.Viswanathan Printers and publishers Private Ltd., Chennai.

Reference Books:

1. M.D. Raisinghania, [2001] Ordinary and Partial Differential Equations, S.Chand and Co., New Delhi.
2. M.R.Spiegel [2005] Advanced Mathematics for Engineers and Scientists, Tata McGraw Hill Edition, New Delhi.
3. M.R.Spiegel [2005] Laplace Transforms, Tata McGraw Hill Edition, New Delhi.
4. S.Sudha [2003] Differential Equations and Integral Transforms, Emerald Publishers, Chennai.
5. M.K.Venkataraman [1998] Higher Engineering Mathematics, III-B, National Publishing Co., Chennai.
6. P.R.Vittal [2004] Differential Equations and Laplace Transform, Margham Publications, Chennai.
7. P.Kandasamy, K.Thilagavathy [2004] Mathematics for B.Sc. Vol. III S.Chand& Co., Ltd., New Delhi-55.
8. B.S.Grewal [2002] Higher Engineering Mathematics, Khanna Publishers, New Delhi.
9. Sheply. L.Ross [1984] Differential Equations, III Edition john Wiley and Sons, New York.

Course Material: website links, e-Books and e-journals
https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx
https://mathworld.wolfram.com/topics/CalculusandAnalysis.html

https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/pages/syllabus/
https://ocw.mit.edu/courses/18-031-system-functions-and-the-laplace-transform-spring-2019/pages/instructor-insights/
http://www.wolfram.com/wolfram-u/introduction-to-differential-equations/
https://www.classcentral.com/course/edx-differential-equations-fourier-series-and-partial-differential-equations-11763

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	M	S	S	S	S
CO2	S	S	S	S	S	M	M	M	S	M
CO3	M	M	M	M	S	S	S	S	S	S
CO4	S	S	S	S	M	M	M	M	M	S
CO5	S	S	S	S	M	M	M	M	M	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: III **Paper type: Skill based subject**

Paper code: S – 01 Name of the Paper: PAPER – 1 – MATHEMATICS FOR COMPETETIVE EXAMINATIONS-I **Credit: 2**

Total Hours per Week: 3 Lecture Hours: 3 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To introduce the concepts of mathematics with emphasis on analytical ability, and computational skills which are required to write the competitive examinations.
2. The students should learn to calculate the LCM and HCF of a pair of integers and of any set of given numbers, and hence that of fractions.
3. To evaluate the square roots of perfect squares and of perfect cubes. To understand that the square roots and cube roots are inverses of squares, cubes respectively. To understand the term average and what it represents.
4. To learn to solve the trickv questions related to ages, asked in banking and other competitive examinations.
5. All students should be able to understand irrational numbers and how they differ from rational numbers.

Course Outcomes

1. After studied unit-1, the student will be able to answer the questions related to the number system.
2. After studied unit-2, the student will be able to answer real-life simple problems by applying the HCF and/or LCM.
3. After studied unit-3, the student will be able to apply the correct sequence of operations to find out the value of a given mathematical expression.
4. After studied unit-4, the student will be able to solve the problems involving square roots, cube roots, and average.
5. After studied unit-5, the student will be able to carry out the problems related to ages, and simplify products and quotients involving surds.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT - I

Number System.

UNIT - II

H.C.F. and L.C.M. of numbers, Decimal Fractions.

UNIT - III

Simplification.

UNIT - IV

Square roots and Cube Roots, Average.

UNIT -V

Problems on Numbers, Problems on Ages, Surds and Indices.

Text book:

1. R.S.Aggarwal, [2017] Quantitative Aptitude for Competitive Examinations, S Chand and Company, New Delhi.

   Chapters 1 to 9.

Reference Book:

1. Praveen R. V. Quantitative Aptitude and Reasoning, PHI Learning Pvt. Ltd, New Delhi.

Course Material: website links, e-Books and e-journals

https://study91.co.in/subject-category-list/math-classes
https://unacademy.com/class/mathematics-for-all-competitive-exams/KDPVC3M1
https://artofproblemsolving.com/wiki/index.php/Resources_for_mathematics_competitions
https://examsdaily.in/free-online-coaching-competitive-exams
https://ariyalur.nic.in/document/tn-government-website-for-preparing-competitive-exams-and-free-online-class/
https://study91.co.in/live-online-classes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	M	S	S	M
CO2	M	S	S	S	S	S	S	M	M	S
CO3	M	S	S	S	S	S	M	S	S	S
CO4	S	S	S	M	S	S	M	M	M	S
CO5	S	M	S	M	M	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: III **Paper type: Non-Major Elective**

Paper code: NME – 01 Name of the Paper: PAPER – 1 – BASIC MATHEMATICS Credit: 2
Total Hours per Week: 2 Lecture Hours: 2 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To provide basic knowledge about set theory, De-Morgan's laws, and distributive tables.
2. The students should understand various types of number systems and the conversion of numbers from one system to another.
3. Explain and exemplify logical statements, tautology, and contradiction.
4. To know about determinants, properties, and applications of determinants.
5. To inculcate various types of matrices, operations on matrices, and their applications.

Course Outcomes

1. After studied unit -1, the student will be able to define subset, proper subset, and equivalent sets and write sets using set notations.
2. After studied unit -2, the student will be able to describe various number systems and convert one number system into another.
3. After studied unit -3, the student will be able to express logical statements and prepares the truth tables.
4. After studied unit -4, the student will be able to find the determinant values 2x2, and 3x3 matrices and solve a system of equations by applying Cramer's rule.
5. After studied unit -5, the student will be able to get a strong background in matrices and be able to solve a system of non-homogeneous equations.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	Yes
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I SETS

Definition - Subsets - Power sets - Equality of sets - Finite and Infinite sets - Set operations - De-Morgan's laws - Distributive tables - Cartesian products.

UNIT - II NUMBER SYSTEM

Binary, octal, hexadecimal numbers - conversion from one system to another system - addition and subtraction - one's complement.

UNIT – III SYMBOLIC LOGICS

Logical statements - connectives - truth tables - tautologies operations - groups - (problems and simple properties only).

UNIT - IV DETERMINANTS
Definition - properties (without proof) - application of determinants - Cramer's rule for the solution of a system of equations

UNIT - V MATRICES
Definition - types of matrices - operations on matrices - adjoint and inverse - applications - solving non-homogeneous equations.

Text books:

1. Dr.M.K.Venkataraman & others, "Discrete mathematics and structures", The National Publishing Company, Madras.
2. Trembly J.P and Manohar.R "Discrete Mathematical Structures with applications to computer science" Tata McGraw - Hill Pub., Co., Ltd. New Delhi 2003.

Reference Books:

1. P.R.Vittal "Algebra, Analytical Geometry and trigonometry" Margham Publications, Chennai.
2. Richard Johnsonbaugh, "Discrete Mathematics" fifth Edn., Pearson Education Asia, New Delhi 2002.

Course Material: website links, e-Books and e-journals
https://alison.com/topic/learn/115323/symbolic-logic-introduction
https://www.openculture.com/symbolic-logic-a-free-online-course
https://www.udemy.com/course/basic-math-course/
https://www.learndirect.com/upskilluk/free-maths
https://infolearners.com/courses/basic-math-online-course-free/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	S	M	M	M
CO2	S	S	S	S	M	M	S	S	S	S
CO3	S	M	S	M	S	S	M	S	M	S
CO4	S	S	M	S	S	S	S	M	S	S
CO5	S	M	S	S	M	S	S	S	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: IV **Paper type: Core**

Paper code: C – 06 Name of the Paper: PAPER – 6 – VECTOR ANALYSIS AND FOURIER SERIES **Credit: 4**

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To know the fundamental concepts of vector calculus, which are essential in applied mathematics.
2. To develop a detailed knowledge about vector differentiation.
3. Knowledge about vector integration.
4. Knowledge about applications of Stoke's, Gauss divergence, and Green's theorems.
5. To study the details of the full-range and half-range Fourier Series.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate knowledge of the physical and geometrical meaning of the derivative and its applications.
2. After studied unit -2, the student will be able to know the concepts of divergence, curl of a vector, and their physical interpretations.
3. After studied unit -3, the student will be able to evaluate the line, surface, and volume integrals.
4. After studied unit -4, the student will be able to know the applications of Stoke's, Gauss divergence, and Green's theorems.
5. After studied unit -5, the student will be able to express the given function as a Fourier series.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	Yes	No
2	Yes	Yes	Yes	No	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	No	Yes	Yes	No	Yes	Yes

UNIT-I: Differential Vector Calculus

Differentiation of a Vector – Geometrical Interpretation of the Derivative - Differentiation Formulae - Velocity and Acceleration Vectors – Scalar and Vector Point functions – Level surface – Gradient – Equation of tangent plae –Unit normal to the given Surface - Differentiation of dot and Cross Products - Partial Derivatives of Vectors - Differentials of Vectors.

UNIT-II: Gradient, Divergence and Curl

Vector Differential Operator Del - Directional Derivative - Geometric Interpretation - Gradient of the sum of Functions; of the product of functions and of a function of function - Operations involving Del - Divergence of a Vector and its Physical

Interpretation - Curl of a Vector and its Physical Interpretation - Expansion Formulae for Operators involving Del - Solenoidal and Irrotational – Simple Problems.

UNIT-III: Vector Integration
The Line Integral - Surface Integral and its Physical Meaning – Volume integral - Simple Problems.

UNIT-IV: Vector Integration(Contd.)
Statements of Stoke's Theorem, Gauss Divergence Theorem and Green's Theorem - Simple Problems – Simple Problems Solved to Verify the Theorems.

UNIT-V: Fourier Series
Euler's Formulae - Conditions for Fourier Expansion - Functions having Discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even periodic Functions - Half-range Series - Parseval's Formula.

Text book:
Erwin Kreyszig (2011), Advanced Engineering Mathematics, John Wiley & Sons, Inc. (10^{th}edition), Printed in the United States of America

Reference Books:

1. G.B.Thomas and R.L.Finney. (1998) *Calculus and Analytic Geometry*, Addison Wesley (9^{th} edition), Mass. (Indian Print).
2. M.K.Venkataraman. (1992) *Engineering Mathematics-Part B*. National Publishing Company, Chennai.
3. P.R.Vittal. (2004) *Vector Calculus, Fourier series and Fourier Transform*. Margham Publications, Chennai.
4. B.S.Grewal (2012). *Higher Engineering Mathematics*, Khanna Publishers(42^{nd}edition), Nai Sarak, New Delhi.
5. S.J.Venkatesan, *Vector Analysis, and Fourier Analysis,* Sri Krishna Publications, Chennai.

Course Material: website links, e-Books and e-journals
https://www.classcentral.com/course/vector-calculus-engineers-17387
https://www.classcentral.com/course/brilliant-vector-calculus-59277
https://www.sydney.edu.au/units/MATH2021
https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/resources/lecture-28-fourier-series-part-1/
https://www.classcentral.com/course/edx-differential-equations-fourier-series-and-partial-differential-equations-11763
https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	M
CO3	M	M	M	M	S	S	S	M	S	S
CO4	M	M	M	M	M	S	S	S	S	M
CO5	M	S	S	S	S	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: IV **Paper type: Core**

Paper code: C – 07 **Name of the Paper: PAPER – 7 – STATICS** **Credit: 4**
Total Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To provide a basic knowledge of the behavior of various types of forces and stresses the development of skills in the formation of suitable mathematical models and problems solving techniques.
2. Knowledge about the equilibrium of a particle under the action of several forces.
3. Domain knowledge about applications involving frictional forces.
4. Basic knowledge about center of mass of different laminas.
5. To acquire basic knowledge about hanging strings and suspension bridges.

Course Outcomes

1. After studied unit -1, the student will be able to know about the forces and equilibrium of a particle.
2. After studied unit -2, the student will be able to identify the parallel forces and couples and solve related problems.
3. After studied unit -3, the student will be able to demonstrate knowledge of friction and its applications.
4. After studied unit -4, the student will be able to find the centre of mass of different laminas.
5. After studied unit -5, the student will be able to demonstrate knowledge of sag and suspension bridge and solve related problems.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	No	Yes	No

Unit : I : Forces on a Particle

Forces – Types of forces – Resultant of three forces related to triangle acting at a point – Resultant of several forces acting on a particle – Equilibrium of a particle under three forces – Equilibrium of a particle under several forces (Chapter 2 : Sections 2.1, 2.2 ; Chapter 3 : Sections 3.1)

Unit – II Forces on a Rigid body

Moment of a force – General motion of a rigid body – Equivalent system of forces – Parallel forces – Forces along the sides of the triangle – Couples (Chapter 4 : Sections 4.1 to 4.6)

Unit – III : Specific Reduction of Forces and Friction

Reduction of coplanar forces into a force and couple – Friction – Laws of friction – Cone of friction and angle of friction – Applications involving frictional forces (Chapter 5 : Sections 5.1, 5.2 (excluding 5.2.1))

Unit – IV : Center of Mass

Center of mass – Center of mass of a triangular lamina – Three particles of same mass – Three particles of certain masses – Uniform rods forming a triangle – Lamina in the form of a trapezium and solid tetrahedron – Center of mass using integration – Circular arc – Circular lamina – Elliptic lamina – Solid hemisphere – Solid right circular cone – Hemispherical shell – Hollow right circular cone – Cardioidal lamina (Chapter 6 : Sections 6.1,6.2,6.2.1, 6.2.2)

Unit – V : Hanging Strings

Equilibrium of a uniform homogeneous string – Equation of the shape of the string hanging under gravity in Cartesian form – Equation of the shape of the string hanging under gravity in parametric form – Sag – Suspension bridge (Chapter 9 : Sections 9.1, 9.2)

Text book:

P.Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam, Mechanics, 6-e, S.Chand and Company Ltd., 2005.

Reference Books:

1. V.Dharmapadam, Statics, S.Viswanathan Pvt.Ltd., Madras, 1974.
2. R.C.Hibbler, Engineering Mechanics, Statics and Dynamics, Macmillan Publishing Company.
3. S.L.Loney, Principle of mechanics, Macmillan and Company Ltd., 1969
4. T.K.Manichavachagam Pillai and Narayanan, Statics, The National Publishing company, Madras 1961
5. T.Natarajan, T.Govinda Rajan, G.R.Venkataraman, K.Muthuswamy, Statics, Rochouse and sons, Madras, Chand and Company Ltd., New Delhi 1970.
6. S.Narayan, R.Hanumantha Rao, K.Sitaraman, P.Kandaswamy, Statics, S.c.

Course Material: website links, e-Books and e-journals

http://mathworld.wolfram.com
https://www.e-booksdirectory.com/details.php?ebook=6650
https://ocw.mit.edu/courses/8-223-classical-mechanics-ii-january-iap-2017/pages/lecture-notes/

https://www.edx.org/learn/mechanics

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	S	M	M	M
CO2	M	M	M	M	S	S	M	M	S	S
CO3	S	M	S	S	M	M	M	M	M	M
CO4	S	S	M	M	M	M	M	M	M	M
CO5	M	M	S	S	S	M	M	M	M	M

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: IV **Paper type: Non-Major Elective**

Paper code: NME – 02 **Name of the Paper: PAPER – 2 – FOUNDATION MATHEMATICS FOR COMPETETIVE EXAMINATIONS** **Credit: 2**

Total Hours per Week: 2 Lecture Hours: 2 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To introduce the concepts of mathematics with emphasis on analytical ability and computational skills required to write the competitive examinations.
2. To acquire basic knowledge to calculate the ratio, proportion, and percentages.
3. To Understand the term percentage and hence the average and what it represents.
4. To learn how to solve the tricky questions based on profit and loss.
5. All students should know the calculations of simple and compound interest. The students will learn the relationship between time/speed/distance through a variety of activities.

Course Outcomes

1. After studied unit-1, the student will be able to solve real-life problems related to percentages.
2. After studied unit-2, the student will be able to carry out real-world problems related to profit and loss.
3. After studied unit-3, the student will be able to demonstrate knowledge of real-life problems based on the ratio and proportions.
4. After studied unit-4, the student will be able to demonstrate knowledge of the work rate formula and apply this technique to solve several real-life problems.
5. After studied unit-5, the students will be able to solve real-life problems based on simple and compound interest.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT - I

Percentage

UNIT - II

Profit and Loss.

UNIT - III

Ratio and proportion

UNIT - IV

Time, Distance and Work

UNIT - V

Simple and Compound Interest**.**

Text book:

R.S.Aggarwal, [2017] Quantitative Aptitude for Competitive Examinations, S Chand and Company, New Delhi.

Chapters 11 to 13, 18, 19, 22, 23.

Reference Book:

Praveen R. V. Quantitative Aptitude and Reasoning, PHI Learning Pvt. Ltd, New Delhi.

Course Material: website links, e-Books and e-journals

https://study91.co.in/subject-category-list/math-classes
https://unacademy.com/class/mathematics-for-all-competitive-exams/KDPVC3M1
https://artofproblemsolving.com/wiki/index.php/Resources_for_mathematics_competitions
https://www.wiziq.com/tutorials/maths-for-competitive-exams
https://www.teacheron.com/online-competitive_maths-tutors

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	S	M	S	S	S
CO2	M	S	S	S	M	S	S	M	M	S
CO3	S	M	S	S	S	S	M	S	S	M
CO4	S	S	S	M	S	S	M	M	M	S
CO5	S	M	S	M	M	M	S	S	M	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Core**

Paper code: C – 08 **Name of the Paper: PAPER – 6 – ABSTRACT ALGEBRA Credit: 4**
Total Hours per Week: 6 Lecture Hours: 6 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To state the group axioms and to verify whether a given set and a binary operation form a group.
2. To define a subgroup, order of an element, order of a group, cyclic group, abelian or commutative group.
3. To compute the order, powers, and inverse of an element with concrete examples.
4. To define and compute cyclic groups, the additive group mod n, the multiplicative group mod p, the symmetric group, and the dihedral group.
5. To state and prove Lagrange's Theorem.
6. To know the fundamental concepts of ring theory, ideals, quotient rings, integral domains, and fields.

Course Outcomes

1. After studied unit-1, the student will be able to determine whether a given set is a group under a binary operation and find its subgroup.
2. After studied unit-2, the student will be able to demonstrate knowledge of normal subgroup, homomorphism, and isomorphism.
3. After studied unit-3, the student will be able to carry out the problems based on permutation.
4. After studied unit-4, the student will be able to demonstrate knowledge of rings, ideals, and integral domain.
5. After studied unit-5, the student will be able to understand the concepts of ideals and Euclidean rings**.**

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I GROUPS

Definition of a Group - Examples - Subgroups - simple problems.

UNIT - II GROUP [CONTD]

Counting Principle - Normal Subgroups - Homomorphism - simple problems.

UNIT – III GROUP [CONTD]

Automorphisms - Cayley's Theorem - Permutation Groups - simple problems.

UNIT - IV RINGS

Definition and Examples of Rings- Some special classes of Rings - Homomorphism of Rings - Ideals and Quotient Rings - simple problems.

UNIT - V RINGS [CONTD]

More Ideals and Quotient Rings - The field of quotients of an Integral domain - Euclidean rings - simple problems.

Text book:

I.N.Herstein.[1989], "Topics in Algebra",[2nd ed] Wiley Eastern Ltd. New Delhi.
Chapter:2 (Sec: 2.1 - 2.10 [Omit Applications 1 and 2 of 2.7]),
Chapter : 3 (Sec: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7)

Reference books:

1. S.Arumugam[2004], "Modern Algebra", SciTech Publications, Chennai.
2. J.B.Fraleigh [1987], "A First Course in Algebra", [3rd edition] Addison Wesley, Mass. [Indian Print]
3. Lloyd R.Jaisingh and Frank Ayres,Jr. [2005], "Abstract Algebra", [2nd edition], Tat McGraw Hill, New Delhi.
4. M.L.Santiago[2002], "Modern Algebra", Tat McGraw Hill, New Delhi
5. SurjeetSingh and Qazi Zameeruddin[1982], "Modern algebra", Vikas Publishing House Pvt.Ltd. New Delhi.

Course Material: website links, e-Books and e-journals

https://tutorial.math.lamar.edu/Extras/AlgebraTrigReview/AlgebraTrig.aspx
https://ocw.mit.edu/courses/18-703-modern-algebra-spring-2013/
https://ocw.mit.edu/courses/18-701-algebra-i-fall-2010/
https://www.classcentral.com/course/swayam-introduction-to-abstract-and-linear-algebra-14142
https://www.classcentral.com/subject/algebra

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	M	S	S	M
CO2	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	M	S	S	S	S	S	S
CO5	S	S	M	S	M	M	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Core**

Paper code: C – 09 Name of the Paper: PAPER – 9 – REAL ANALYSIS – I Credit: 4

Total Hours per Week: 6 Lecture Hours: 6 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To explore the topics such as convergence and divergence of sequences and series, the limit of a function on the real line, metric spaces, continuous functions, open sets, and closed sets.
2. To identify the subsequence of a given sequence, test whether a given sequence is convergent or divergent.
3. To know about convergence and divergence of sequences and series, and test the convergence of sequences and series.
4. To acquire fundamental knowledge about metric spaces and limits on metric spaces.
5. To inculcate the knowledge about continuous functions on a metric space, open sets, and closed sets.

Course Outcomes

1. After studied unit -1, the student will be able to identify countable sets, the limit of a sequence, and its convergence.
2. After studied unit -2, the student will be able to demonstrate knowledge of divergent sequence, bounded sequence, monotone sequence, and Cauchy sequence.
3. After studied unit -3, the student will be able to carry out convergence and divergence of series and related problems.
4. After studied unit -4, the student will be able to express metric spaces and convergent and divergent sequences in a metric space.
5. After studied unit -5, the student will be able to demonstrate knowledge of open sets and closed sets with suitable examples.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I FUNCTIONS AND SEQUENCES

Functions - real valued functions - equivalence - countability and real numbers - least upper bound - definition of sequence and subsequence - limit of a sequence - convergent sequence - Simple problems.

Ch. 1.4 to 1.7, 2.1 to 2.3.

UNIT - II SEQUENCES [CONTD...]

Divergent sequences - Bounded sequences - Monotone sequence - Operations on convergent sequences - Operations on divergent sequences - Limit superior and Limit inferior - Cauchy sequences - Simple problems.

Ch. 2.4 to 2.10.

UNIT - III SERIES OF REAL NUMBERS

Convergence and Divergence - Series with non negative terms - Alternating series - conditional convergence and Absolute convergence - Test for Absolute convergence - Simple problems.

Ch. 3.1 to 3.4 and 3.6.

UNIT - IV SERIES OF REAL NUMBERS [CONTD...]

Test for Absolute convergence - The class ℓ^2 - Limit of a function on the real line - Metric spaces - Limits in Metric spaces - Simple problems.

Ch. 3.7, 3.10, 4.1 to 4.3.

UNIT - V CONTINUOUS FUNCTIONS ON METRIC SPACES

Functions Continuous at a point on the real line - Reformulation - Functions Continuous on a Metric Spaces - Open Sets - Closed Sets - simple problems.

Ch. 5.1 to 5.5.

Text book:

R.Goldberg [2000] Methods of Real Analysis. Oxford & IBH Publishing Co., New Delhi.

Reference books:

1. Tom M.Apostol [1974] Mathematical Analysis, 2nd Edition, Addison-Wesley New York.
2. Bartle, R.G. and Shebert [1976] Real Analysis, John Wiley and Sons Inc., New York.
3. Malik, S.C. and SavitaArora [1991] Mathematical Analysis, Wiley Eastern Limited, New Delhi.
4. Sanjay Arora and BansiLal [1991], Introduction to Real Analysis, SatyaPrakashan, New Delhi.

Course Material: website links, e-Books and e-journals

https://mathworld.wolfram.com/topics/CalculusandAnalysis.html
https://ocw.mit.edu/courses/18-100a-real-analysis-fall-2020/
https://ocw.mit.edu/courses/18-100b-analysis-i-fall-2010/
https://ocw.mit.edu/courses/18-s097-introduction-to-metric-spaces-iap-2022/
https://pkalika.in/2019/09/06/real-analysis/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	S	S	M	M	M	S
CO2	S	S	M	M	M	M	M	M	M	S
CO3	S	S	S	M	M	S	S	M	S	S
CO4	M	M	M	S	S	S	M	M	M	M
CO5	M	S	S	M	M	M	M	S	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Core**

Paper code: C – 10 **Name of the Paper: PAPER – 10 – DYNAMICS** **Credit: 4**

Total Hours per Week: 6 Lecture Hours: 6 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To introduce the study of the motion of particles or bodies under the influence of forces and to provide a basic knowledge of the behavior of objects in motion.
2. Knowledge about Projectiles.
3. To acquire knowledge about simple harmonic motions.
4. Basic knowledge about different types of Impacts.
5. To understand the knowledge about various methods to find the central orbits.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate knowledge of velocity, acceleration, and coplanar motion.
2. After studied unit -2, the student will be able to gain knowledge of projectile and its applications.
3. After studied unit -3, the student will be able to know about simple harmonic motion and simple pendulum.
4. After studied unit -4, the student will be able to carry out problems related to impact and laws of impact.
5. After studied unit -5, the student will be able to demonstrate knowledge of the central orbits.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	Yes
3	Yes	Yes	Yes	No	Yes	No
4	Yes	Yes	Yes	No	Yes	Yes
5	No	Yes	Yes	Yes	Yes	Yes

Unit – I : Kinematics

Introduction – Velocity – Relative velocity – Angular velocity – Acceleration – Rectilinear motion – Rectilinear motion with a constant acceleration – Relative angular velocity – Coplanar motion (Chapter I : Sections 1.2 to 1.4)

Unit – II : Simple Harmonic Motion

Simple harmonic motion – Projection of a particle having a uniform circular motion – composition of two simple harmonic motions of same period – Simple harmonic motion along a horizontal line – Simple harmonic motion along a vertical line – Motion under gravity in a resisting medium (Chapter 12: Sections 12.1, 12.3, 12.4)

Unit – III : Projectiles

Forces on a projectile – Displacement as a combination of vertical and horizontal displacements – Nature of trajectory – Maximum horizontal range for a given velocity – Two trajectories with a given speed and range – Projectile projected horizontally – Projectile projected on an inclined plane – Maximum range on a inclined plane – Enveloping parabola (Chapter 13 : Sections 13.1 to 13.3)

Unit – IV : Impact

Impulsive force – Conservation of linear momentum – Impact of a sphere – Laws of impact – Impact of two smooth spheres – Direct impact of two smooth spheres – Direct impact of a smooth sphere on a plane – Oblique impact of a smooth sphere on a plane – Oblique impact of two smooth spheres. (Chapter 14 : Sections 14.1 to 14.5)

Unit – V : Central orbits

Differential equation of a central orbit – Laws of a central force – Methods to find the central orbits (Chapter 16: Sections 16.1, 16.2)

Text book:

P.Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam, Mechanics, S.Chand and Company Ltd., 2010.

Reference books:

1. A.V.Dharmapadam, Dynamics, S.Viswanathan Pvt Ltd., 1981
2. S.J.Loney, Dynamics of a particle, Macmillan and Company Ltd., 1969
3. John L.Synage, Byron A.Griffth, Principles of Mechanics, McGraw Hill International Book Company, Singapore, 1970
4. M.K.Venkataraman, Text book of Dynamics, Sharma's Sanatorium press, Pudukottai, 1990

Course Material: website links, e-Books and e-journals

http://mathworld.wolfram.com
https://www.classcentral.com/course/rigid-body-dynamics-20108
https://nptel.ac.in/courses/112106286
https://ocw.mit.edu/courses/8-223-classical-mechanics-ii-january-iap-2017/pages/lecture-notes/
https://www.edx.org/learn/mechanics

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	M	S	M
CO2	M	S	M	M	S	M	S	M	M	S
CO3	S	M	S	S	M	S	S	M	S	M
CO4	M	M	M	S	S	S	M	M	S	S
CO5	M	S	S	M	M	M	M	S	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Elective**

Paper code: E – 01 Name of the Paper: PAPER – 1A – LINEAR PROGRAMMING Credit:3
Total Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To describe the role of mathematical models in operations research and decision making.
2. Formulate a real-life problem into a linear programming problem.
3. To solve an LPP by graphical and other methods.
4. To acquire knowledge of transportation and assignment problems.
5. To understand a knowledge of simulation and its applications

Course Outcomes

1. After studied unit-1, the student will be able to formulate a real-world problem into an LPP and carry out the calculations of the simplex method.
2. After studied unit-2, the student will be able to solve transportation problems.
3. After studied unit-3, the student will be able to understand analogies between transportation problems and assignment models.
4. After studied unit-4, the student will be able to demonstrate knowledge of game theory and its applications.
5. After studied unit-5, the student will be able to know the concept of simulation and solve the problems by applying the Monte Carlo simulation technique.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT - I

Linear programming problem - Mathematical formulation of the problem - Graphical solution method - Simplex method - The Big-M method -Duality - Dual simplex method (Simple Problems).

UNIT - II

Definitions of the transportation model - Formulation and solution of transportation models - Finding an initial basic feasible solution (NWCM - LCM -VAM) - Degeneracy in Transportation Problem - Transportation Algorithm (MODI Method)

UNIT - III

Definition of Assignment models - Mathematical representation of assignment models - Comparison with the transportation models - Solution of the assignment model - The Hungarian methods for solution of the assignment models - variation of the assignment

problem - Travelling salesman problem.

UNIT - IV

Games and Strategies - Two person zero sum - Some basic terms - the maximin-minimax principle - saddle points - Games without saddle points-Mixed strategies - graphic solution 2xn and mx2 games.

UNIT - V

Simulation - applications - advantages and disadvantages - Monte Carlo method - simple problems.

Text book:

Gupta P.K.and Hira D.S., (2000) Problems in Operations Research, S.Chand & Co. Delhi

Reference Books

1. J.K.Sharma, (2001) Operations Research: Theory and Applications, Macmillan, Delhi
2. KantiSwaroop, Gupta P.K. and Manmohan, (1999) *Problems in Operations Research*, Sultan Chand & Sons., Delhi.
3. V.K.Kapoor [1989] *Operations Research*, sultan Chand & sons.
4. Ravindran A., Philips D.T. and Solberg J.J., (1987) *Operations research*, John Wiley & Sons, New York.
5. Taha H.A. (2003) *Operations Research,* Macmillan Publishing Company, New York.
6. S.J.Venkatesan, *Operations Research,* J.S. Publishers, Cheyyar-604 407.

Course Material: website links, e-Books and e-journals

https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/resources/lecture-15-linear-programming-lp-reductions-simplex/
https://www.mygreatlearning.com/academy/learn-for-free/courses/linear-programming-examples
https://www.studocu.com/en-us/document/university-at-buffalo/advanced-topics-in-computer-science/lecture-notes-introduction-to-linear-programming-1/647312
https://www.udemy.com/course/operation-research-a-course-on-linear-programming-problems/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	M
CO2	M	S	S	M	S	S	S	S	S	S
CO3	S	S	M	S	M	S	M	S	S	S
CO4	S	M	S	S	S	S	S	M	M	S
CO5	S	S	S	S	S	S	S	S	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Elective**

Paper code: E – 01 Name of the Paper: PAPER – 1B – SPECIAL FUNCTIONS Credit:3
Total Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To develop computational skills in certain special functions which are frequently occurring in higher mathematics and mathematical physics.
2. Learn the concepts of simultaneous linear differential equations and some solvable types of nonlinear equations.
3. Basic knowledge about numerical solutions using the Taylor series.
4. To understand the concepts of Bessel functions, Legendre functions, and their properties.
5. To give an insight about Fourier integral, term by term differentiation of Fourier series and Legendre series.

Course Outcomes

1. After studied unit -1, the student will be able to acquire the concept of linear operators, and solve simultaneous linear differential equations.
2. After studied unit -2, the student will be able to interpret Adams and Modified Adams method and extrapolation techniques.
3. After studied unit -3, the student will be able to understand the concept of power series solution.
4. After studied unit -4, the student will be able to explain the concepts of Bessel functions, Legendre functions, and their properties.
5. After studied unit -5, the student will be able to analyze term-by-term differentiation of the Fourier series and Legendre series.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT-I:

Properties of Linear Operators - Simultaneous Linear Differential Equations - Special Solvable Types of Nonlinear Equations.

UNIT-II:

Numerical Solutions Using Taylor Series - Adams and Modified Adams Method - Extrapolation with Differences

UNIT-III:

Properties of Power Series - Examples - Singular Points of Linear Second Order Differential Equations - Method of Frobenius.

UNIT-IV:
Bessel Functions - Properties - Legendre Functions.

UNIT-V:
Term by Term Differentiation of Fourier Series, Legendre Series - Fourier Integral.

Recommended Text

1. F.B.Hildebrand. (1977) Advanced Calculus for Applications. Prentice Hall. New Jersey.

Reference Books

1. J.N.Sharma and R.K.Gupta (1998) Special Functions, Krishna Prakashan Mandir, Meerut.
2. Satya Prakash. (2004)Mathematical Physics. Sultan & Sons. New Delhi.
3. B.D.Gupta (1978) Mathematical Physics, Vikas Publishing House.

Course Material: website links, e-Books and e-journals
special-function-kalika124pages.pdf
https://mathworld.wolfram.com/topics/CalculusandAnalysis.html
https://alison.com/topic/learn/127039/special-functions

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	S	M	S	M
CO2	S	M	S	S	M	S	S	S	M	S
CO3	M	M	S	S	S	S	M	S	S	M
CO4	S	S	M	S	S	M	S	M	S	S
CO5	M	S	S	M	S	S	S	S	M	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Elective**

Paper code: E – 02 **Name of the Paper: PAPER – 2A – GRAPH THEORY** **Credit:3**

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To impart the knowledge of graph theory and study the basic concepts of graphs, and subgraphs.
2. To study operations on graphs and adjacency and incidence of matrices.
3. Knowledge about connectedness and components.
4. To acquire knowledge about connectivity theorems on graphs.
5. Knowledge about Eulerian and Hamiltonian graphs.

Course Outcomes

1. After studied unit -1, the student will be able to know various graph structures and isomorphism between graphs.
2. After studied unit -2, the student will be able to know the representation of the graphs in matrix form.
3. After studied unit -3, the student will be able to know the concepts of connected graph, component, cut point, and bridge of a graph.
4. After studied unit -4, the student will be able to know about trees and their applications.
5. After studied unit -5, the student will be able to demonstrate knowledge of Eulerian and Hamiltonian graphs.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	No	Yes	Yes	No	Yes	Yes
2	No	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	No	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	No	Yes	Yes

UNIT - I

Graphs - subgraphs - Degree of a vertex - Isomorphism of graphs -Ramsey numbers - independent sets and coverings.

UNIT - II

Intersection graphs - Adjacency and incidence of matrices - Operations on graphs - Simple problems.

UNIT - III

Walks, trails and paths - Connectedness and components - cut points - bridges - blocks.

UNIT - IV

Connectivity theorems and simple problems –Trees - Theorems and simple problems.

UNIT - V

Eulerian graphs and Hamiltonian graphs - Necessary and sufficient conditions - Theorems and simple problems.

Text book:

S.Arumugam and S.Ramachandran, "Invitation to Graph Theory", SCITECH Publications India Pvt. Ltd., T.Nagar, Chennai - 17. 2001.

Unit 1	Chapter 2	Section 2.1 to 2.6
Unit 2	Chapter 2	Section 2.7 to 2.9
Unit 3	Chapter 4	Section 4.1 to 4.3
Unit 4	Chapter 4	Section 4.4
	Chapter 6	Section 6.1, 6.2
Unit 5	Chapter 5	Section 5.1, 5.2

Reference Books

1. S.Kumaravelu, SusheelaKumaravelu, Graph Theory, Publishers, Nagercoil-629 002.

2. S.A.Choudham, A First Course in Graph Theory, Macmillan India Ltd.

3. Robin J.Wilson, Introduction to Graph Theory, Longman Group Ltd.

Course Material: website links, e-Books and e-journals

http://www.stanford.edu/class/cs103x/
https://mathworld.wolfram.com/topics/GraphTheoryhtml
htpps://nptel.ac.in/courses/111/106/111106102/
https://ocw.mit.edu/courses/18-217-graph-theory-and-additive-combinatorics-fall-2019/
https://ocw.mit.edu/courses/18-304-undergraduate-seminar-in-discrete-mathematics-spring-2015/
https://ocw.mit.edu/courses/18-315-combinatorial-theory-introduction-to-graph-theory-extremal-and-enumerative-combinatorics-spring-2005/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	M	M	S	S	S	S
CO2	M	M	M	S	M	M	S	S	M	S
CO3	M	M	M	S	M	S	S	S	S	S
CO4	S	S	M	M	S	M	M	S	M	S
CO5	S	S	S	M	S	S	M	M	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Elective**

Paper code: E – 02 Name of the Paper: PAPER – 2B – DISCRETE MATHEMATICS

Credit:3

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. This course aims to develop mathematical maturity and the ability to deal with abstraction and to develop construction and verification of formal logical manipulation.
2. To expose to different techniques about recurrence relations and solutions of homogeneous and non-homogeneous relations.
3. To study mathematical logic and form a truth table of a formula.
4. To acquire knowledge about modular and distributive lattices and the properties of lattices.
5. Knowledge about Boolean polynomials.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate knowledge of recurrence relations and generating functions.
2. After studied unit -2, the student will be able to form a truth table and know the concepts of tautological implications and equivalence of formulae.
3. After studied unit -3, the student will be able to know the concepts of functionally complete sets of connectives and duality law.
4. After studied unit -4, the student will be able to demonstrate knowledge of modular and distributive lattices and the properties of lattices.
5. After studied unit -5, the student will be able to understand the concepts of Boolean Algebra, Boolean polynomials, and Karnaugh Maps.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I RECURRENCE RELATIONS AND GENERATING FUNCTIONS

Recurrence - Polynomials and their Evaluations - Recurrence Relations - Solution of Finite Order Homogeneous [linear] Relations - Solutions of Non-homogeneous Relations.

UNIT - II MATHEMATICAL LOGIC

TF Statements - Connectives - Atomic and Compound Statements - Well-formed [Statement Formulae] - Parsing - Truth Table of a Formula - Tautology - Tautological Implications and Equivalence of Formulae.

UNIT - III MATHEMATICAL LOGIC [CONTD..]

Replacement process - Functionally complete sets of connectives and Duality law - Normal Forms - Principal Normal Forms.

UNIT - IV LATTICES

Lattices [omit example 15 Pp No.10.6) - Some properties of Lattices - New Lattices (omit remarkPp 10.14) - Modular and Distributive Lattices (omit theorem 10 and 17, Example 4 - Pp 10.23,Example 11 - Pp 10.24)

UNIT - V BOOLEAN ALGEBRA

Boolean Algebra (omit theorem 25) - Boolean Polynomials - Karnaugh Maps (omit K-map for 5and 6 variables)

Text book:

M.K.Venkataraman, N.Sridharan and N.Chandrasekaran, [2003] Discrete Mathematics, The National Publishing Company, Chennai.

Reference Books

1. R.Johnsonbaugh [2001] Discrete Mathematics [5th Edn.] Pearson Education, Asia.,
2. C.L.Liu, [1985] elements of Discrete Mathematics, McGraw Hill, New York,
3. J.Truss. [2000] Discrete Mathematics for Computer Scientists [2nd Edn.] Pearson Education, Asia.
4. M.K.Sen and B.C.Chakraborthy [2002] Discrete Mathematics [2nd Edition,] Books and allied private Ltd., Kolkata.

Course Material: website links, e-Books and e-journals

https://mathworld.wolfram.com/topics/DiscreteMathematics.html
https://ocw.mit.edu/courses/18-304-undergraduate-seminar-in-discrete-mathematics-spring-2015/
https://www.coursera.org/learn/discrete-mathematics
https://click.linksynergy.com/deeplink?id=nFJR8bwmzBk&mid=39197&murl=https%3A%2F%2Fwww.udemy.com%2Fcourse%2Fdiscrete-mathematics-open-doors-to-great-careers%2F
https://onlinecourses.nptel.ac.in/noc20_cs82/preview

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	M	S	S	S	S	S
CO2	S	S	M	S	S	S	S	S	S	S
CO3	M	M	M	M	M	S	M	S	M	M
CO4	S	S	M	S	S	S	S	S	M	S
CO5	S	M	S	M	S	M	S	M	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: V **Paper type: Skill based subject**

Paper code: S – 03 **Name of the Paper: PAPER – 3 – MATHEMATICS FOR COMPETETIVE EXAMINATIONS-III** **Credit: 2**

Total Hours per Week: 3 Lecture Hours: 3 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To introduce the concepts of mathematics with emphasis on analytical ability and computational skills required to write the competitive examinations.
2. Students will learn the relationship between time/speed/distance through a variety of activities.
3. Students should learn a few tricks which may help them to solve the boat and stream - related problems in the quantitative aptitude section faster and without errors.
4. Students learn the detailed concept of alligation along with some of the important formulae to solve the questions related to this topic.
5. To acquire the basic knowledge about simple, compound interest, and calculating areas of different shapes.

Course Outcomes

1. After studied unit -1, the student will be able to solve the problems related to time and distance.
2. After studied unit -2, the student will be able to carry out the boat and stream, train, and speed- based questions.
3. After studied unit -3, the student will answer the questions based on alligation or mixture. Aspirants preparing for the upcoming competitive examinations will be able to answer such questions in a faster way.
4. After studied unit -4, the student will be able to carry out problems related to compound interest.
5. After studied unit -5, the student will be able to demonstrate knowledge of area-related problems.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I

Time and Distance.

UNIT - II

Boats and Streams, Problems on Trains.

UNIT - III

Alligation or Mixture, Simple Interest.

UNIT - IV

Compound Interest.

UNIT - V

Area.

Text book:

1. R.S.Aggarwal, [2017] Quantitative Aptitude for Competitive Examinations, S Chand and Company, New Delhi.

Chapters 18 to 24.

Reference Book:

1.Praveen R. V. Quantitative Aptitude and Reasoning, PHI Learning Pvt. Ltd, New Delhi.

Course Material: website links, e-Books and e-journals
https://study91.co.in/subject-category-list/math-classes
https://unacademy.com/class/mathematics-for-all-competitive-exams/KDPVC3M1
https://artofproblemsolving.com/wiki/index.php/Resources_for_mathematics_competitions
https://examsdaily.in/free-online-coaching-competitive-exams

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	S	S	S	M
CO2	M	S	S	M	S	M	S	M	M	S
CO3	S	M	M	S	M	S	M	S	S	M
CO4	M	S	M	M	S	M	S	S	M	S
CO5	S	S	S	M	S	S	M	M	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Core**

Paper code: C – 11 **Name of the Paper: PAPER – 11 – LINEAR ALGEBRA** **Credit: 4**

Total Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To introduce the concepts of vector spaces.
2. To learn the concepts of dual spaces.
3. Knowledge about the algebra of linear transformations.
4. Basic knowledge about linear transformations and their properties related to a matrix.
5. To know about matrices, determinants, and their properties.

Course Outcomes

1. After studied unit -1, the student will be able to identify linear dependent and independent vectors.
2. After studied unit -2, the student will be able to classify orthogonal and orthonormal vectors.
3. After studied unit -3, the student will be able to know about the algebra of linear transformations.
4. After studied unit -4, the student will be able to know about the matrix of a linear transformation and its properties.
5. After studied unit -5, the student will be able to solve a system of linear equations.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	No	Yes	No

UNIT - I

VECTOR SPACES
Linear dependence and independence - Bases – Dimension – Basic concepts and examples.

UNIT - II

VECTOR SPACES [CONTD]
Dual spaces - Annihilator of a Subspace - inner product spaces.

UNIT - III

LINEAR TRANSFORMATIONS

Algebra of linear transformations - Sub Algebra - Minimal Polynomial - Invertible - Characteristics roots - Characteristic Vectors.

UNIT - IV

LINEAR TRANSFORMATIONS [CONTD]

Matrices - Matrix of a Linear Transformation and its Properties- Canonical forms - triangular forms - Invariant Transformation - Triangular Matrix of 'T'

UNIT - V

LINEAR TRANSFORMATIONS [CONTD]

Trace and Transpose: Definition and Properties-Jacobson Lemma- Symmetric, Skew Symmetric and Adjoint of a matrix - Determinants: Definition and Properties- Solving system of Linear Equations-Secular Equation.

Text book:

I.N.Herstein [1989], "Topics in Algebra", Wiley Eastern Ltd. New Delhi.
Chapters - 4 & 6(Sec: 4.1, 4.2, 4.3, 4.4 & 6.1, 6.2, 6.3, 6.4, 6.8, 6.9).

Reference books:

1. S.Arumugam.[2004], "Modern Algebra", Scitech Publications, Chennai.
2.J.B.Fraleigh [1987], "A First Course in Algebra", [3rd edition] Addison Wesley, Mass. [Indian Print]
3. Lloyd R.Jaisingh and Frank Ayres,Jr. [2005], "Abstract Algebra", [2nd edition], Tata McGraw Hill, New Delhi.
4. M.L.Santiago[2002], "Modern Algebra", Tata McGraw Hill, New Delhi
5. Surjeet Singh and Qazi Zameeruddin[1982], "Modern algebra", Vikas Publishing House Pvt.Ltd. New Delhi.

Course Material: website links, e-Books and e-journals

https://www.classcentral.com/course/youtube-vector-spaces-80274
https://wolframalpha.com/examples/mathematics/linear-algebra
http://linear.ups.edu/index.html
https://open.umn.edu/opentextbooks/textbooks/5
https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/pages/syllabus/
https://ocw.mit.edu/courses/18-702-algebra-ii-spring-2011/
http://www.wolfram.com/wolfram-u/introduction-to-linear-algebra/
https://www.classcentral.com/course/edx-linear-algebra-ii-matrix-algebra-20932
https://www.classcentral.com/course/brilliant-linear-algebra-59261
https://www.classcentral.com/course/swayam-introduction-to-abstract-and-linear-algebra-14142
https://www.classcentral.com/subject/algebra
https://www.classcentral.com/course/edx-introduction-to-linear-models-and-matrix-algebra-2963
https://pkalika.in/2019/10/21/abstract-algebra-linear-algebra/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	S	S	S	M
CO2	S	S	S	S	M	S	S	M	M	S
CO3	M	S	S	S	M	S	M	S	S	M
CO4	S	S	M	S	S	M	S	M	M	S
CO5	S	M	S	M	S	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Core**

Paper code: C – 12 **Name of the Paper: PAPER – 12 – REAL ANALYSIS II** **Credit: 4**

Total Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To attain a strong knowledge about the concepts of connected, complete, bounded, totally bounded, and compact spaces.
2. To acquire basic knowledge about continuous and uniformly continuous functions on compact metric spaces.
3. To understand the definition of Riemann integral and its properties.
4. To study the results of Rolle's theorem, the law of mean, fundamental theorems of calculus, and Taylor's theorem and carry out simple problems related to these concepts.
5. To know about pointwise convergence, uniform convergence of sequences of functions, convergence, and uniform convergence of series of functions.

Course Outcomes

1. After studied unit-1, the student will be able to demonstrate knowledge of connected sets and complete metric spaces with suitable examples.

2. After studied unit-2, the student will be able to identify the functions which are continuous and uniformly continuous.

3. After studied unit-3, the student will be able to express about Riemann integration and its properties.
4. After studied unit-4, the student will be able to carry out the problems related to Rolle's theorem and the law of mean.

5. After studied unit-5, the student will be able to demonstrate knowledge of pointwise convergence, uniform convergence of sequences of functions, and of series of functions.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT - I CONNECTEDNESS, COMPLETENESS

Open Sets - Connected Sets - Bounded Sets and Totally Bounded Sets - Complete Metric Spaces - simple problems. Ch. 6.1 to 6.4 of Goldberg

UNIT - II COMPACTNESS

Compact Metric Space - Continuous Functions on Compact Metric Spaces - Continuity of Inverse Functions - Uniform Continuity - simple problems.
Ch. 6.5 to 6.8 of Goldberg

UNIT - III RIEMANN INTEGRATION

Sets of measure zero - Definition Riemann Integral - Properties of Riemann Integral - Derivatives - simple problems.

Ch. 7.1, 7.2 7.4, 7.5 of Goldberg.

UNIT - IV RIEMANN INTEGRATION [CONTD...]

Rolle's Theorem - The law of mean - Fundamental theorems of calculus - Taylor's theorem - simple problems.

Ch. 7.6 to 7.8 and 8.5 of Goldberg.

UNIT - V SEQUENCES AND SERIES OF FUNCTIONS

Pointwise convergence of sequences of functions - Uniform convergence of sequences of functions - consequences of uniform convergence - Convergence and uniform convergence of series of functions - simple problems.

Ch. 9.1 to 9.4 of Goldberg.

Text book:

R.Goldberg, Methods of Real Analysis Oxford & IBH Publishing Co., New Delhi.

Reference Books:

1. Tom M.Apostol [1974] Mathematical Analysis, 2nd Edition, Addison-Wesley Publishing Company Inc. New York.
2. Bartle, R.G. and Shebert [1976] Real Analysis, John Wiley and Sons Inc., New York,
3. Malik, S.C. and Savita Arora [1991] Mathematical Analysis, Wiley Eastern Limited, New Delhi.
4. Sanjay Arora and Bansi Lal [1991] Introduction to Real Analysis, Satya Prakashan, New Delhi.

Course Material: website links, e-Books and e-journals

https://ocw.mit.edu/courses/18-100b-analysis-i-fall-2010/
https://ocw.mit.edu/courses/18-s097-introduction-to-metric-spaces-iap-2022/
https://pkalika.in/2019/09/06/real-analysis/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	M	S	S	S	M	M	S	S	S	M
CO3	S	S	M	S	S	S	S	S	S	S
CO4	M	S	S	S	S	S	M	S	S	S
CO5	S	M	S	S	S	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Core**

Paper code: C – 13 **Name of the Paper: PAPER – 13 – COMPLEX ANALYSIS** **Credit: 4**

Total Hours per Week: 5 Lecture Hours: 5 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To study the techniques of complex variables and functions together with their derivatives, and applications of analytic functions, harmonic functions, and their properties.
2. To understand the concepts of conformal mapping, bilinear transformations, and related problems.
3. To evaluate a complex integral using parameterization, and apply the results of Cauchy's fundamental theorem and Cauchy's integral formula.
4. A strong knowledge of Taylor's and Laurent's series, classifications of singularities, and evaluation of integrals using Cauchy's residue theorem.
5. To evaluate contour integrals or integrals over the real line

Course Outcomes

1. After studied unit-1, the student will be able to gain knowledge about complex functions and their nature, continuous functions, necessary and sufficient conditions of an analytic function.
2. After studied unit-2, the student will be able to demonstrate knowledge of elementary transformations, conformal and bilinear transformations with examples.
3. After studied unit-3, the student will be able to evaluate contour integrals using Cauchy's integral formula.
4. After studied unit-4, the student will be able to express a function as Taylor series or Laurent's series at the given domain, and also determine the circle or annulus of convergence power series expansions of analytic functions.
5. After studied unit-5, the student will be able to carry out the problems related to the evaluation of improper integrals.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	NO	Yes	Yes	Yes	Yes	NO
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	NO	Yes	NO	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	NO
5	Yes	Yes	Yes	Yes	Yes	NO

UNIT - I ANALYTIC FUNCTIONS

Complex valued functions-Mappings - Limits - Theorems on Limits(statement only)

Continuity - Derivatives and Differentiation formulas(without proof) - Cauchy-Riemann equations - Sufficient conditions - Cauchy - Riemann equations in polar form - properties of Analytic functions - Harmonic functions - Determination of Harmonic conjugate- problems.

UNIT – II CONFORMAL MAPPINGS & MAPPING BY ELEMENTARY FUNCTIONS

Conformal mapping - Isogonal mapping - Further properties - The transformations $w=z+d$, $w=\frac{1}{z}$, $w=z^2$, $w=z+d$, $w=e^z$, $w=\sin z$ - Bilinear Transformations – problems

UNIT – III INTEGRALS

Contours - Line Integrals - Cauchy-Goursat's Theorem (without proof) - Cauchy's Integral Formula - Derivatives of Analytic Functions - Morera's theorem - Maximum Moduli of functions - The fundamental theorem of Algebra - Liouville's theorem and the Fundamental Theorem on Algebra .

UNIT – IV POWER SERIES, SINGULARITIES AND RESIDUES

Taylor's and Laurent's theorem – Examples - Singularities and classifications - Isolated singularties- Removable singularity, Pole and essential singularity - Residues - Cauchy's Residue theorem - problems.

UNIT – V CONTOUR INTEGRATION

Evaluation of Improper Real Integrals - Improper integrals involving Trigonometric functions - simple problems.

Text book:

R.V.Churchill and J.W.Brown, (1984) *Complex Variables and Applications*. McGraw Hill International Book Co., Singapore. (Fourth Edition)

Reference Books

1. P. Duraipandian and Laxmi Duraipandian. Complex Analysis: Emerald Publishers, Chennai. 1976.
2. S. Ponnusamy. Foundations of Complex Analysis, Narosa Publishing House, New Delhi. 2000.
3. Tyagi B.S. Functions of Complex Variable, 17th Edition, Pragati Prakasham Publishing Company Ltd., Meerut, 1992 - 93.

Course Material: website links, e-Books and e-journals

https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/
https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-fall-1999/pages/syllabus/

https://ocw.mit.edu/courses/18-112-functions-of-a-complex-variable-fall-2008/pages/syllabus/
https://pkalika.in/2019/07/01/complex-analysis/
https://mathworld.wolfram.com/topics/CalculusandAnalysis.html

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Core**

Paper code: C – 14 Name of the Paper: PAPER – 14 – PROGRAMMING IN C LANGUAGE **Credit: 3**

Total Hours per Week: 3 Lecture Hours: 3 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To make the students abreast with the programming concepts and master them in C Language.
2. To learn the basic structures of C programs and execute a 'C' Program.
3. Knowledge about data types, declaration of variables, storage class, and assigning values to variables.
4. To obtain basic knowledge about various operators, evaluation of expressions, and precedence of arithmetic operators.
5. Knowledge about formatted input and output, decision making with branching, looping, and arrays.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate 'c' tokens, keywords, the basic structure of C programs and the execution of a 'C' Program.
2. After studied unit -2, the student will be able to express the nature of constants, variables, data types, declaration of variables, and assigning values to variables.
3. After studied unit -3, the student will be able to describe valuation of expressions and usage of various operators.
4. After studied unit -4, the student will be able to express the logic using control statements.
5. After studied unit -5, the student will be able to demonstrate knowledge pertaining to arrays.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT –I: OVERVIEW OF C

Basic Structure of C Programs- Programming style- Executing a 'C' Programs –'c' Tokens- Keywords and Identifiers.

UNIT – II: CONSTANTS , VARIABLES & DATA TYPE

Constants-Variables-Data Types- Declaration of Variables- Declaration of Storage Class- Assigning values to variables.

UNIT – III: OPERATORS AND EXPRESSION

Arithmetic Operators-Relational operators- Logical operators-Assignment operators-Increment and decrement operators-Conditional operators-Evaluation of Expressions-Precedence of Arithmetic operators.

UNIT –IV: FORMATTED INPUT,OUTPUT & DECISION MAKING AND BRANCHING

Formatted input- Formatted output- Decision making with 'IF' statement- Simple IF statement-The IF….ELSE statement-Nesting of IF…ELSE statement-The ELSE IF ladder-The switch statement – The ?: Operators- The GOTO statement.

UNIT – V: DECISION MAKING AND LOOPING & ARRAYS

The WHILE statement-The DO statement-The FOR statement- Jumps in LOOPS-One dimensional array-Declaration of one dimensional arrays-Initialization of one dimensional arrays-Two dimensional arrays-Multi dimensional arrays.

TEXT BOOK:

1. E. Balagurusamy [1996], "Programming in ANSI C" .Tata McGraw Hill.

Unit:I Chap:1(1.8-1.10),Chap:2 (2.3,2.4)
Unit:II Chap:2 (2.5-2.10),
Unit:III Chap: 3 (3.2-3.12),
Unit-IV Chap:4 (4.4,4.5),Chap:5 (5.2-5.9),
Unit:V Chap:6 (6.2-6.5),Chap:7(7.2-7.7)

REFERENCE BOOKS:

1. V.Rajaraman [1995], "Computer Programming In C", Prentice Hall. New Delhi.
2. H.Schildt, Obsborne (1994), "Teach Yourself C", McGraw Hill, New York ,Mullish Cooper.
3. "The Spirit of C – An Introduction to Modern Programming",Jaico Publishing House. Delhi. 1998.
4. YashavantKanetkar, "Let Us C", 6th edition BPB publication.

Course Material: website links, e-Books and e-journals

https://lecturenotes.in/subject/1/programming-in-c-c
https://lecturenotes.in/subject/805/c-language
https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/
http://www.freebookcentre.net/programming-books-download/Lecture-Note-On-Programming-In-C.html
https://www.technicalsymposium.com/Cprogramming_Contents.html

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	M	S	M	S	M	M
CO2	M	S	M	M	S	S	M	S	M	M
CO3	M	S	M	M	M	S	S	M	M	S
CO4	S	M	S	S	S	M	M	S	S	M
CO5	S	S	M	S	M	S	M	S	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Core Practical**

Paper code: CP – 1 Name of the Paper: PAPER – 1 – PRACTICAL IN C LANGUAGE

Credit: 2

Total Hours per Week: 3 Lecture Hours: 3 Tutorial Hours: ….. Practical Hours: …..

……

The following exercises shall be performed as minimum mandatory requirements [for eligibility to take the practical examination] and a RECORD of the code-listing and outputs shall be maintained by each student.

1. Assigning the ASCII value.
2. Square of numbers: Using For loop,
3. Square of numbers: While loop
4. Square of numbers: Do- while loop,
5. Square of numbers: Go to statement.
6. Printing Alphabets between two letters
7. Counting Vowels and consonants.
8. Printing Prime number between two numbers
9. Fibonacci series
10. Factorial numbers
11. Power of a value
12. Checking Palindrome in string
13. Sin(X) series
14. Cos(X) series
15. Pascal Triangle
16. Binary search
17. Matrix Transpose
18. Matrix Addition
19. Matrix Subtraction
20. Matrix Multiplication

REFERENCE BOOKS:

1. "The spirit if C", Mulish Cooper, Indian edition by jaicopubishers, 1987.
2. "Teach yourself C", Herbert Scheldt, McGraw-Hill, 2nd edition 1994 Programming in C-Schaum series.

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Elective**

Paper code: E – 03Name of the Paper: PAPER – 3A – OPERATIONS RESEARCH Credit:3

Total Hours per Week: 3 Lecture Hours: 3 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To develop computational skills and logical thinking in formulating industry - oriented problems as a mathematical problems and obtaining optimal solutions to the problems.
2. To learn about splitting and arranging the activities of a project as a network diagram and determine a critical path and its duration.
3. Knowledge about programme evaluation and review techniques (PERT).
4. Basic knowledge about inventory control models and determining EOQ levels.
5. To study steady-state analysis of various queuing models with finite and infinite capacities.

Course Outcomes

1. After studied unit -1, the student will be able to determine the critical activities of a repeated project and its completion time.
2. After studied unit -2, the student will be able to determine the duration of activities of a new project based on three-time estimates.
3. After studied unit -3, the student will be able to carry out the EOQ level of various inventory control models.
4. After studied unit -4, the student will be able to calculate processing times of sequencing of jobs through 2, 3, and m machines.
5. After studied unit -5, the student will be able to find out the length of the queue, and waiting time in the queue under single and multi-channel queuing models.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	No
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I

Network logic-Numbering the events-Construction of network diagram-Critical path method (CPM) - Three floats

UNIT - II

Three time estimates-Network scheduling by PERT Method

UNIT - III

Inventory models - EOQ model (a) Uniform demand rate infinite production rate with no shortages (b) Uniform demand rate infinite production rate with shortages allowed (c) Uniform demand rate finite production rate with no shortages (d) Uniform demand rate finite production rate with shortages allowed - Inventory control with Price Breaks.

UNIT - IV

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

UNIT - V

Queuing Theory - Basic concepts - Steady state analysis of M/M/1 and M/M/N systems with finite and infinite capacities - Multi-channel queuing model (M/M/C)/FCFS/∞/∞) .

Text book:

Gupta P.K. and Hira D.S. (2000) *Problems in Operations Research*, S.Chand & Co. Delhi

Reference Books

1. J.K.Sharma, (2001) Operations Research: Theory and Applications, Macmillan, Delhi
2. KantiSwaroop, Gupta P.K. and Manmohan, (1999) *Problems in Operations Research*, Sultan Chand & Sons., Delhi.
3. V.K.Kapoor [1989] *Operations Research*, sultan Chand & sons.
4. Ravindran A., Philips D.T. and Solberg J.J., (1987) *Operations research*, John Wiley & Sons, New York.
5. Taha H.A. (2003) *Operations Research,* Maocmillan Publishing Company, New York
6. S.J.Venkatesan, *Operations Research,* J.S. Publishers, Cheyyar-604 407.

Course Material: website links, e-Books and e-journals

https://lecturenotes.in/subject/573/operations-research-or
https://onlinecourses.nptel.ac.in/noc20_ma23/preview
https://examupdates.in/operation-research-notes/
https://collegetutor.net/notes/Operation_Research_Notes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	M	S	S	S	M	M	S	S	S	M
CO3	S	S	M	S	S	S	S	S	S	S
CO4	M	S	S	S	S	S	M	S	S	S
CO5	S	M	S	S	S	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Elective**

Paper code: E – 03 Name of the Paper: PAPER – 3B – FUZZY MATHEMATICS Credit:3

Total Hours per Week: 3 Lecture Hours: 3 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To acquire background knowledge about the fundamentals of fuzzy Algebra.
2. To know the basic definitions and concepts of fuzzy theory.
3. To know the applications of fuzzy technology.
4. To study the Algebra of fuzzy relations and logic-connectives.
5. To learn the concepts of fuzzy invariant subgroups and fuzzy subrings

Course Outcomes

1. After studied unit -1, the student will be able to know fuzzy sets and their operations.
2. After studied unit -2, the student will be able to know the addition and product of two fuzzy sets.
3. After studied unit -3, the student will be able to demonstrate knowledge of fuzzy relations and logic-connectives.
4. After studied unit -4, the student will be able to express about fuzzy subgroup, homomorphic image, and pre-image of subgroupoid.
5. After studied unit -5, the student will be able to demonstrate knowledge of fuzzy invariant subgroups and subrings.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I

Introduction- Fuzzy subsets-Lattices and Boolean Algebras- L fuzzy sets-operations on fuzzy -α level sets - properties of fuzzy subsets of a set.
Sections 1.1-1.10

UNIT - II

Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and product-Cartesian product of fuzzy subsets.
Sections 1.11-1.13.

UNIT - III

Introduction- Algebra of fuzzy relations-logic-connectives.
Sections 2.1-2.4

UNIT - IV

Some more connectives-Introduction-fuzzy subgroup-homomorphic image and Pre-image of subgroupoid.
Sections 2.5,3.1-3.3

UNIT - V

Fuzzy invariant subgroups-fuzzy subrings.
Section 3.4 and 3.5.

Text book:

S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi.

Reference Books

1. Apostolos Syropoulos, A Modern Introduction to Fuzzy Mathematics, Wiley & Sons, Inc, 2020.

Course Material: website links, e-Books and e-journals
https://www.classcentral.com/course/swayam-introduction-to-fuzzy-set-theory-arithmetic-and-logic-14149/
https://worldcat.org/oclc/1141919783
https://onlinecourses.nptel.ac.in/noc21_ma55/preview
Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	S	S	S	M
CO2	M	M	M	S	M	M	S	M	M	S
CO3	M	M	M	S	M	S	M	S	S	M
CO4	S	S	M	M	S	M	M	S	M	S
CO5	S	M	S	M	S	S	M	M	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: VI **Paper type: Elective**

Paper code: E – 03Name of the Paper: PAPER – 3C – R Programming (Practical) Credit:3
Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: 3

……

Using R Programming develop the programs in the following topics:

1. Arithmetic and matrix operations.
2. Simple functions
3. Plotting Bar chart and scatter plot
4. Plotting histogram and pie chart
5. Graphics for grouped data
6. Graphical display of distributions
7. Measures of central tendency -Mean, median, mode
8. Measures of Dispersion- std. deviation, mean deviation
9. Regression and correlation. Linear models.
10. Large sample tests
11. Small sample test t- tests
12. Small sample test F-tests
13. Small sample test Chi-square tests
14. ANOVA(one way)
15. ANOVA (Two way)

Reference Books:

1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters Beginner's Guide to R - Springer, 2009.
2. Allerhand M. Tiny Handbook of R - SpringerBriefs in Statistics, 2011
3. Baayen R. Analyzing Linguistic Data - A Practical Introduction to Statistics using R , 2008.
4. Gardener M. Beginning R - The Statistical Programming Language , 2012.
5. Jim Albert, Maria Rizzo R by Example, 2012.
6. Matloff N. Art of R Programming - A Tour of Statistical Software Design , 2011.

Course Material: website links, e-Books and e-journals
https://www.classcentral.com/course/edx-statistics-and-r-2960
https://www.classcentral.com/course/probability-intro-6099

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: I/III **Paper type: Allied**

Paper code: A – 01 Name of the Paper: PAPER – 1 – MATHEMATICAL STATISTICS - I

Credit:3

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To know the fundamental concepts of Statistics.
2. Learn to apply Baye's theorem to real-life problems.
3. To know the concepts such as expectation, moments, and distribution function.
4. To know the applications of correlation and rank correlation.
5. To learn some standard discrete and continuous distributions and their applications.

Course Outcomes

1. After studied unit -1, the student will be able to express the techniques of conditional probability and Baye's theorem with examples.
2. After studied unit -2, the student will be able to calculate expectation, and distribution function.
3. After studied unit -3, the student will be able to express Chebychev's inequality and its applications.
4. After studied unit -4, the student will be able to interpret the different types of correlation coefficient and lines of regression with examples.
5. After studied unit -5, the student will be able to apply domain knowledge for discrete and continuous distributions with examples.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	No	Yes	No
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

UNIT-I: PROBABILITY THEORY

Axiomatic approach to probability - Some theorems on Probability - Conditional Probability - Multiplication theorem of probability - Independent events - Baye's Theorem - Simple Problems.

[Chapter 3, sec 3.8 (3.8.1;3.8.2;3.8.5;3.8.6), sec 3.9 (3.9.1,3.9.2), sec 3.10 - 3.13; Chapter 4, sec 4.2]

UNIT –II: RANDOM VARIABLES, DISTRIBUTION FUNCTIONS AND

MATHEMATICAL EXPECTATION.

Random Variables (Discrete and Continuous) - Distribution Function – Mathematical Expectation – Expected value of function of a random variable – properties of expectation – properties of variance – covariance.

[Chapter 5, sec 5.2-5.4; Chapter 6, sec 6.2-6.6]

UNIT-III: GENERATING FUNCTIONS.

Moment generating function - Characteristic Function - Uniqueness and Inversion Theorem (Statement only) - Chebychev's Inequality - Simple Problems.

[Chapter 7, sec 7.1,7.3 - 7.5]

UNIT-IV CORRELATION AND REGRESSION.

Concept of Bivariate Distribution - Correlation - Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression.

[Chapter 10, sec 10.4-10.7, Chapter 11, sec 11.2]

UNIT-V

Standard distributions: Discrete distributions - Binomial, Poisson, Hyper Geometric and Negative Binomial Distributions - Continuous Distributions Normal, Uniform, Exponential.

[Chapter 8, sec 8.4(8.4.1-8.4.8), sec 8.5(8.5.1-8.5.6), sec (8.6.1; 8.6.3-8.6.5), sec 8.8; Chapter 9, sec 9.2 (9.2.1-9.2.5), sec 9.3, sec 9.8]

Text book: S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan & sons , (11^{th} edition, June 2002).

Reference Books

1. Hogg, R.V. &Craig.A.T.(1998) : Introduction to Mathematical Statistics, Macmillan
2. Mood. A.M. Graybill. F.A.&Boes.D.G.(1974) : Introduction to theory of Statistics, McGraw Hill.
3. Snedecor.G.W. &Cochran.W.G.(1967) : Statistical Methods, Oxford and IBH
4. Hoel, P.G (1971): Introduction to Mathematical Statistics, Wiley.
5. Wilks S.S. Elementary Statistical Analysis, Oxford and IBH

Course Material: website links, e-Books and e-journals

https://mathworld.wolfram.com/topics/ProbabilityandStatistics.html

https://ocw.mit.edu/courses/18-175-theory-of-probability-spring-2014/
https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2014/
https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/
https://ocw.mit.edu/courses/18-600-probability-and-random-variables-fall-2019/
https://ocw.mit.edu/courses/18-655-mathematical-statistics-spring-2016/
https://www.wolfram.com/broadcast/video.php?c=420&v=1630
https://www.classcentral.com/course/youtube-statistics-110-probability-91487/classroom
https://people.richland.edu/james/lecture/m170/
https://ocw.mit.edu/courses/18-650-statistics-for-applications-fall-2016/resources/lecture-1-introduction-to-statistics/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	S
CO2	S	S	S	S	M	S	S	S	M	S
CO3	M	S	S	S	S	S	M	S	S	M
CO4	S	S	M	S	S	M	S	S	S	S
CO5	S	M	S	M	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: II/IV **Paper type: Allied**

Paper code: A – 02 Name of the Paper: PAPER – 2 – MATHEMATICAL STATISTICS -II
Credit:3

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To know the Statistical investigations and the applications of sampling techniques in our day-to-day life.
2. Learn the applications of Chi-square distribution.
3. To understand the concepts such as Students t, F, and Z distributions and their properties.
4. To know the various methods of estimation and testing of hypothesis techniques.
5. To apply ANOVA technique to verify whether all samples are drawn from the same population.

Course Outcomes

1. After studied unit -1, the student will be able to demonstrate sampling, parameter, and significance with examples.
2. After studied unit -2, the student will be able to know about Chi-square distribution and its applications.
3. After studied unit -3, the student will be able to illustrate Students t-distribution and the applications of F-distribution.
4. After studied unit -4, the student will be able to state null and alternate hypotheses to the given problem and test the hypothesis.
5. After studied unit -5, the student will be able to apply ANOVA techniques.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	No	Yes	No
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	No	Yes	No

UNIT - I

Statistical Population Census and Sampling Survey - Parameter and Statistics - Sampling and Sampling Distribution and Standard Error. Sampling distributions - students ‘t’, chi - square and F distributions.
Sampling and large sample test

Chapter: 12 Page 307- 333

UNIT - II

Test of significance - Large sample test for proportion, mean and standard deviation - Exact test based on 't', Chi - square and F distribution with respect to population mean, variance and correlation coefficient - Tests of independence of attributes - goodness of fit tests.
Exact sampling distribution (Chi-square distribution)

Chapter:13 Page 334 - 351

UNIT - III

Point estimation - Concept of unbiasedness, consistency, efficiency and sufficiency - Cramer- Rao Inequality - Methods of Estimation - Maximum Likelihood Estimation - Method of Moments.
Exact sampling distribution- t, F and Z distribution

Chapter:14 Page 352-370

UNIT - IV

Test of Hypothesis: Null and Alternate Hypothesis - Type I and Type II error - Power of the test - Neymann Pearson lemma - Likelihood Ratio Test - Concept of Most Powerful test (Statement and Results only) - Simple Problems
Theory of estimation, testing of hypothesis

Ch:15 and 16 Pages: S.1-S.15 and S.18-S.30

UNIT - V

Analysis of Variance - One - way and Two-way Classification - Basic Principles of Design of Experiments - Randomization, Replication, Local Control, Completely Randomized Design, Randomized Block Design and Latin Square Design.
Analysis of variance, Design of experiments

Chapter: 17 and 18 Page: S.31-S.46 and S.47-S.75

Text book: S.C. Gupta & V.K. Kapoor: Elements of Mathematical Statistics, Third extensively revised and greatly improved edition, Sultan Chand & sons.

Books for Reference

1. Hogg, R.V. & Craig. A. T. (1998): Introduction to Mathematical Statistics, Macmillan
2. Mood.A.M.,Graybill. F.A.&Boes. D.G.(1974): Introduction to theory of Statistics, McGraw Hill.
3. Snedecor.G.W. &Cochran.W.G.(1967): Statistical Methods, Oxford and IBH
4. Hoel.P.G (1971): Introduction to Mathematical Statistics, Wiley.
5. Wilks . S. S.Elementary Statistical Analysis, Oxford and IBH
6. O. Kempthone - Design of Experiments

7. Das and Giri : Design of Experiments Wiley Eastern

Course Material: website links, e-Books and e-journals

https://mathworld.wolfram.com/topics/ProbabilityandStatistics.html
https://ocw.mit.edu/courses/18-175-theory-of-probability-spring-2014/
https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2014/
https://ocw.mit.edu/courses/18-655-mathematical-statistics-spring-2016/
https://www.wolfram.com/broadcast/video.php?c=420&v=1630
https://www.classcentral.com/course/youtube-statistics-110-probability-91487/classroom
https://people.richland.edu/james/lecture/m170/
https://ocw.mit.edu/courses/18-650-statistics-for-applications-fall-2016/resources/lecture-1-introduction-to-statistics/

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	S	M	S	S	S	M
CO2	S	S	S	S	M	S	S	M	M	S
CO3	M	S	S	S	S	S	M	S	S	M
CO4	S	S	M	S	S	M	S	S	S	S
CO5	S	M	S	M	S	M	S	S	M	M

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semesters:I, II (or) III, IV **Paper type: Practical(Allied)**

Paper code: A – 03 **Name of the Paper: MATHEMATICAL STATISTICS** **Credit:2**

Total Hours per Week: 2 Lecture Hours: Tutorial Hours: ….. Practical Hours: 2

……

LIST OF PROBLEMS

1. Measures of location and Dispersion (absolute and relative)
2. Computation of Correlation Coefficient for raw and Grouped data, Rank Correlation Coefficient
3. Computation of Regression Equations for Raw and Grouped Data
4. Curve Fitting by the Method of Least Squares
   a. $y=ax+b$
   b. $y=ax^2+bx+c$
   c. $y=ae^{bx}$
   d. $y=ax^b$
5. Fitting of Binomial, Poisson, Normal distributions and tests of goodness of fit.
6. Large sample tests with regard to population mean, proportion, standard deviation
7. Exact tests with respect to Mean, Variance and Coefficient of Correlation
8. Test for Independence of Attributes based on Chi-Square Distribution
9. Calculation of Confidence Intervals based on Normal, t and Chi-square and F Distributions
10. Problems based on ANOVA-one way and two way Classification
11. Completely Randomized Design
12. Randomized Block Design
13. Latin Square Design

Note

Use of scientific calculator shall be permitted for practical examination. Statistical and Mathematical tables are to be provided to the students at the examination hall.

- Mathematics faculty alone should be appointed as examiners.

Books for Reference

1. Hogg, R.V. &Craig.A.T.(1998): Introduction to Mathematical Statistics, Macmillan.
2. Mood.A.M. ,Graybill. F.A.&Boes.D.G.(1974) : Introduction to theory of Statistics, McGraw Hill.
1. Snedecor.G.W. &Cochran.W.G.(1967): Statistical Methods, Oxford and IBH

2. Hoel.P.G (1971): Introduction to Mathematical Statistics, Wiley.
3. S.C. Gupta & V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan &sons
4. S.C. Gupta & V.K. Kapoor: Fundamentals of Applied Statistics, Sultan & sons
5. Wilks . S. S. Elementary Statistical Analysis, Oxford and IBH
6. O. Kempthone - Design of Experiments.

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: I/III **Paper type: Allied**

Paper code: A – 02 Name of the Paper: PAPER – 1 – NUMERICAL METHODS – I Credit:3
Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objective

1. To know the methods of solving simultaneous linear equations.
2. To acquire knowledge about forward differences and Backward differences and their relationship.
3. Knowledge about central difference operators and problems based on various central differences formulae.
4. To study Newton's divided difference formula and problems based on Lagrange's interpolation formula.
5. Knowledge about Summation of series up to n terms.

Course Outcomes

1. After studied unit -1, the student will be able to solve simultaneous linear equations by Gauss elimination method, Gauss-Jordan Method, and Gauss-Seidel method.
2. After studied unit -2, the student will be able to calculate interpolation values by applying Gregory-Newton's forward and backward formulae.
3. After studied unit -3, the student will be able to calculate the central interpolation values by applying central differences formulae.
4. After studied unit -4, the student will be able to estimate one or more missing terms of the given set of data.
5. After studied unit -5, the student will be able to estimate the interpolation value for unequal intervals based on Lagrange's formula of inverse interpolation.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	No	Yes	Yes

UNIT - I SOLUTIONS OF SIMULTANEOUS LINEAR EQUATIONS

Gauss elimination method - matrix inversion method - Gauss-Jordan Method, Gauss-Seidel method (Three unknowns only).

UNIT - II FINITE DIFFERENCES

First and higher order differences - forward differences and Backward differences - Properties of operators - Differences of a Polynomial - Factorial Polynomials - Operator E, Relation between Δ, ∇ and E – Interpolation: Gregory-Newton - forward & backward formulae for interpolation.

UNIT - III CENTRAL DIFFERENCES

Central difference Operators - Central differences formulae: Gauss Forward and Backward formulae - Stirling's formula - Bessel's formula.

UNIT - IV INTERPOLATION FOR UNEQUAL INTERVALS

Divided differences - Newton's divided difference formula - Lagrange's interpolation formula- Estimating the Missing terms (With one or more missing values).

UNIT - V INVERSE INTERPOLATION

Lagrange's formula of inverse interpolation and Reversion of series method (Using Newton's forward formula only).

Summation of series: Sum to n term of the series whose general term is the first difference of a function-summation by parts.

Text book: 1. B.D. Gupta.(2001) *Numerical Analysis.*Konark Pub. Ltd., Delhi
2. M.K. Venkataraman. (1992) *Numerical methods for Science and Engineering* National Publishing Company, Chennai.

Books for Reference

1. S. Arumugam. (2003) *Numerical Methods*, New Gamma Publishing, Palayamkottai.
2. H.C. Saxena. (1991) *Finite differences and Numerical analysis* S.Chand & Co., Delhi
3. A.Singaravelu (2004). *Numerical Methods*Meenakshi Agency, Chennai
4. P.Kandasamy, K.Thilagavathy (2003) Calculus of Finite differences & Numerical Analysis, S. Chand & Company Ltd., New Delhi-55.

Course Material: website links, e-Books and e-journals

https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus/
https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2004/

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	M	S	S	S	S
CO2	S	S	S	S	M	S	S	S	M	S
CO3	M	S	S	S	S	S	M	S	M	M
CO4	S	S	M	S	S	M	S	S	S	S
CO5	S	M	S	M	S	S	S	M	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semester: II/IV **Paper type: Allied**

Paper code: A – 02 Name of the Paper: PAPER – 2 – NUMERICAL METHODS –IICredit:3

Total Hours per Week: 4 Lecture Hours: 4 Tutorial Hours: ….. Practical Hours: …..

……

Course Objective

1. To evaluate derivatives using Newton's forward and backward differences formulae.
2. To acquire the knowledge about evaluation of numerical integration.
3. To evaluate the solution of linear homogeneous difference equations with constant coefficients.
4. To obtain numerical solutions to the algebraic and transcendental equations.
5. To obtain numerical solutions to the ordinary differential equations.

Course Outcomes

1. After studied unit -1, the student will be able to evaluate derivatives by applying Newton's forward and backward differences formulae.
2. After studied unit -2, the student will be able to evaluate integrations by applying the trapezoidal rule, Simpson's rules, and Weddle's rule.
3. After studied unit -3, the student will be able to find a complete solution to linear difference equations.
4. After studied unit -4, the student will be able to estimate approximate numerical solutions of algebraic and transcendental equations.
5. After studied unit -5, the student will be able to estimate approximate numerical solutions of ordinary differential equations by Euler, Picard, Taylor, and Runge-Kutta methods.

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	Yes	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

UNIT - I NUMERICAL DIFFERENTIATION

Newton's forward and backward differences to compute derivatives-derivative using divided differences formula - maxima and minima using the above formulae.

UNIT - II NUMERICAL INTEGRATION

General Quadrature formula-Trapezoidal rule-Simpson's one third rule- Simpson's three-eight rule, Weddle's rule- Euler-Maclaurin Summation Formula

UNIT - III DIFFERENCE EQUATIONS

Linear differences equations-Linear homogeneous difference equations with constant co-efficients-Particular integrals for a^x, x^m, sinax, cosax and a^x f(x).

UNIT - IV SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Bisection method - Iteration method - Regula-falsi method (False Position Method) - Newton-Raphson Method.

UNIT - V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (FIRST ORDER ONLY)

Euler's method- Euler's modified method-Picard's method - Taylor's methods-Runge-Kutta method (Fourth order only).

Text book: 1. B.D. Gupta.(2001) *Numerical Analysis,* Konark Pub. Ltd., Delhi
2. M.K. Venkataraman. (1992) *Numerical methods for Science and Engineering,* National Publishing Company, Chennai.

Books for Reference

1. Gupta, Malik, Calculus of finite differences and Numerical Analysis, Krishna Prakashan Media, Meerut Seventh Edition.
2. S.C.Saxena, Calculus of finite differences and Numerical Analysis, S.Chand& Co., New Delhi. IX Edition.
3. A.Singaravelu, Numerical methods, Meenakshi Publications-First Edition 1992.
4. P.Kandasamy, K.Thilagavathy (2003) Calculus of Finite Differences & Numerical Analysis, S.Chand & Company Ltd., New Delhi-55.

Course Material: website links, e-Books and e-journals

https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus/
https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2004/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	M	S	S
CO2	M	S	S	S	M	M	S	S	M	S
CO3	M	S	S	S	S	S	M	S	S	M
CO4	S	S	M	S	S	S	S	S	S	S
CO5	M	M	S	M	S	S	S	M	M	S

PO – Programme Outcome, CO – Course outcome
S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MATHEMATICS – 2022-2023 onwards

Semesters:I, II (or) III, IV **Paper type: Practical(Allied)**

Paper code: A – 03 Name of the Paper: NUMERICAL METHODS **Credit:2**

Total Hours per Week: 2 Lecture Hours: Tutorial Hours: ….. Practical Hours: 2

……

LIST OF PROBLEMS

1. Derivatives by Newton’s method
2. Gauss elimination method.
3. Gauss-Jacobi method.
4. Gauss-Seidel method.
5. Newton's forward and backward interpolation.
6. Lagrange interpolation.
7. Trapezoidal and Simpson one-third rules.
8. Euler's method.
9. Picard’s method
10. Runge-Kutta's method.