

# **B.Sc. MATHEMATICS**

## **Course Structure and Syllabus**

(For the candidates admitted from the academic year 2024-2025 onwards)

**CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED  
CURRICULUM FRAMEWORK (CBCS-LOCF)**



**THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)**

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

(Affiliated to Bharathidasan University, Tiruchirappalli)

**ELAMBALUR, PERAMBALUR – 621 220**



## **Vision**

To blossom as an institution of excellence, enabling, empowering and enlightening the youth and shaping them as fully developed human beings with the capacity to unfold their full mental potentiality resulting in the attainment of the wisdom to live constructively and meaningfully.

## **Mission**

- To provide Congenial and Stress- free Environment and opportunities for the enhancement of knowledge and acquisition skills through the best exposure and training possible.
- To offer multifaced and need-based academic programmes and to promote extension activities.
- To adopt technology-enabled new methods, approaches and techniques so that the teaching-learning process becomes learner-centred and learner-friendly approach.
- To maximize the participation of all the stakeholders in the development of the institution and the region.
- To sensitize the youth towards inclusive growth for socio-economic change, sustainable development, gender equality, eco-friendliness, etc.
- To enable the youth to experience the effects of globalization and facilitate them to grow as responsible citizens and leaders.
- To inspire them, through value-based education, to embrace the entire humanity while firmly rooted in the Indian ethos.
- To provide regular placement training and placement opportunities.
- To kindle the spirit of creativity and enhance research activities and enable them to attain international standards.

## **Programme Outcomes (POs)**

Upon completion of the Programme, the undergraduate will be able to

1. Acquire knowledge, understand concepts and apply new ideas which enable them to be employable or self-employed.
2. Demonstrate motivation in advancing to higher learning programmes.
3. Engage in socially responsible behavior and have value added education.
4. Have exposure to technical proficiency, analytical capability, soft skills and life skills development.
5. Develop broad understanding in the basic concepts of Languages/ Commerce/Management Studies/Physical Sciences/Computing Sciences/Biological Sciences/Life Science.

## **Program Specific Outcomes (PSOs)**

1. Critical and Analytical Thinking Skill.
2. Student equipped with mathematical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
3. Develop the skills necessary to formulate and understand proofs and to provide justification.
4. A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.
5. Provided advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.

**Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur - 621 220**

**B.Sc. MATHEMATICS**

**CHOICEBASEDCREDITSYSTEM–LEARNINGOUTCOMESBASED CURRICULUM FRAMEWORK**

**(CBCS- LOCF)**

**(For the candidates admitted from the academic year 2024 - 2025 onwards)**

Semester	Part	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
1	I	23UT1/H1	Language – Tamil I	6	3	3	25	75	100
1	II	23UE1	English – English I	6	3	3	25	75	100
1	III	23UMA1CC1	Algebra and Trigonometry	5	5	3	25	75	100
1	III	23UMA1CC2	Differential Calculus	6	5	3	25	75	100
1	III	23UCA1AC1	Programming Language with Python	5	3	3	25	75	100
I	IV	23UMA1SE1	Skill Enhancement Course-1(NME-1)	2	2	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
<b>Total</b>				<b>30</b>	<b>21</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>600</b>
2	I	23UT2/H2	Language – Tamil II	6	3	3	25	75	100
2	II	23UE2	English – English II	6	3	3	25	75	100
2	III	23UMA2CC3	Analytical Geometry (3D) and Fourier Series	5	5	3	25	75	100
2	III	23UMA2CC4	Integral Calculus	5	5	3	25	75	100
2	III	23UCA2AP1	Programming Language with Python (Practical)	4	3	3	40	60	100
2	IV	23UMA2SE2	Skill Enhancement Course-2(NME-2)	2	2	3	25	75	100
2	IV	23UMA2SE3	Computational Mathematics	2	2	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
<b>Total</b>				<b>30</b>	<b>23</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>700</b>
3	I	23UT3/H3	Language – Tamil III	6	3	3	25	75	100
3	II	23UE3	English - English III	6	3	3	25	75	100
3	III	23UMA3CC5	Vector Calculus and Applications	5	5	3	25	75	100
3	III	23UMA3CC6	Elements of Mathematical Analysis	5	4	3	25	75	100
3	III	23UMA3AC2	Mathematical Statistics	4	3	3	25	75	100
3	IV	23UMA3SE4	Statistical Functions in Excel – Practical	2	2	3	40	60	100
3	IV	23UHW	Health and Wealth	1	1	-	-	-	100
3	IV	23UGS	Gender Studies	1	1	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
<b>Total</b>				<b>30</b>	<b>22</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>900</b>

Semester	Part	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
4	I	23UT4/H4	Language – Tamil IV	6	3	3	25	75	100
4	II	23UE4	English – English IV	6	3	3	25	75	100
4	III	23UMA4CC7	Industry Module – Optimization Techniques	6	5	3	25	75	100
4	III	23UMA4CC8	Differential Equations and Applications	5	5	3	25	75	100
4	III	23UMA4AP2	Mathematical Statistics - Practical	3	3	3	40	60	100
4	IV	23UMA4SE5	Soft Skill Development	2	2	3	25	75	100
4	IV	23UES	Environmental Studies	2	2	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
<b>Total</b>				<b>30</b>	<b>23</b>	-	-	-	<b>700</b>
5	III	23UMA5CC9	Abstract Algebra	6	5	3	25	75	100
5	III	23UMA5CC10	Real Analysis	6	4	3	25	75	100
5	III	23UMA5CC11	Statics	6	4	3	25	75	100
5	III	23UMA5DE1	Laplace and Fourier Transforms	5	4	3	25	75	100
5	III	23UMA5DE2	Discrete Mathematics	5	4	3	25	75	100
5	IV	23UVE	Value Education	2	2	3	25	75	100
5	IV		Summer Internship**		2*				
			Value Added Course*		2*	2	50	50	100*
<b>Total</b>				<b>30</b>	<b>23</b>	-	-	-	<b>600</b>
6	III	23UMA6CC12	Linear Algebra	6	6	3	25	75	100
6	III	23UMA6CC13	Complex Analysis	6	5	3	25	75	100
6	III	23UMA6CC14	Dynamics	5	5	3	25	75	100
6	III	23UMA6CC15	Project with Viva-Voce	3	3	-	20	80	100
6	III	23UMA6DE3	Numerical Methods with Applications	5	4	3	25	75	100
6	III	23UMA6DE4	Graph Theory and Applications	5	4	3	25	75	100
6	V		Extension Activity	-	1	-	-	-	-
			Value Added Course*		2*	2	50	50	100*
<b>Total</b>				<b>30</b>	<b>28</b>	-	-	-	<b>600</b>
<b>Grand Total</b>				<b>180</b>	<b>140</b>				<b>4000</b>

\*\* Summer Internship after 4<sup>th</sup> semester during summer vacation -30 Hours and 2 credits will be included in the 5<sup>th</sup> semester.

**\*Extra Credit Course which will not be included in the total CGPA**

\*Value added course (Outside Instruction hours: 30 hours)

**Course details:**

S.No.	Course details	No. of Courses & Credits	Total Credits
1.	Tamil - Part I	4 * 3	12
2.	English - Part II	4 * 3	12
<b>PART - III</b>			
3.	Core Course	1 * 6 = 6 10 * 5 = 50 3 * 4 = 12	68
4.	Project with Viva-Voce	1 * 3	03
5.	Allied Course	2 * 3	06
6.	Allied Practical	2 * 3	06
7.	Discipline Elective	4 * 4	16
<b>PART - IV</b>			
8.	Skill Enhancement Courses	3 * 2	06
9.	Entrepreneurial Skill	1 * 2	02
10.	Soft Skill	1 * 2	02
11.	Environmental Studies	1 * 2	02
12.	Value Education	1 * 2	02
13.	Summer Internship	1 * 2	02*
14.	Gender Studies	1 * 1	01
15.	Health and Wealth	1 * 1	01
<b>PART - V</b>			
16.	Extension Activity	1(Credit Only)	01

**List of Core Course (PART – III)**

S. No	Core Course	Course Name
1.	Core Course I	Algebra and Trigonometry
2.	Core Course II	Differential Calculus
3.	Core Course III	Analytical Geometry (3D) and Fourier Series
4.	Core Course IV	Integral Calculus
5.	Core Course V	Vector Calculus and Applications
6.	Core Course VI	Elements of Mathematical Analysis
7.	Core Course VII	Industry Module – Optimization Techniques
8.	Core Course VIII	Differential Equations and Applications
9.	Core Course IX	Abstract Algebra
10.	Core Course X	Real Analysis
11.	Core Course XI	Statics
12.	Core Course XII	Linear Algebra
13.	Core Course XIII	Complex Analysis
14.	Core Course XIV	Dynamics
15.	Core Course XV	Project With Viva Voce

**List of Allied Courses (PART – III)**

S. No	Allied Course	Course Name
1.	Allied Course I	Programming Language with Python
2.	Allied Course II	Programming Language with Python (Practical)
3.	Allied Course III	Mathematical Statistics
4.	Allied Course IV	Mathematical Statistics - Practical

**List of Discipline Specific Elective Course: (PART – III)**

S. No	Discipline Specific Elective Course	Course Name
1.	Course I	Laplace and Fourier Transforms
2.	Course II	Discrete Mathematics
3.	Course III	Numerical Methods with Applications
4.	Course IV	Graph Theory and Applications

**Skill Enhancement Courses (SEC): (PART – IV)**

S. No	Skill Enhancement Courses	Course Name
1.	SEC – I (NME – I)	
2.	SEC – II (NME – II)	
3.	SEC – III	Computational Mathematics
4.	SEC – IV (Entrepreneurial Skill)	Statistical Functions in Excel – Practical
5.	SEC – V	Soft Skills Development

**Skill Enhancement Courses offered to Other Department**

23UMA1SE1 – Quantitative Aptitude and Logical Reasoning

23UMA2SE2 – Mathematics for Competitive examinations

**PART - IV**

23UES – Environmental Studies

23UGS – Gender Studies

23UVE – Value Education

Summer Internship\*

**PART - V**

Extension Activity

**List of Value Added Courses**

S. No	Course	Course Code	Course Name
1.	Value Added Course	23UMAVA1	Basic Mathematics
2.	Value Added Course	23UMAVA2	Arithmetical ability
3.	Value Added Course	23UMAVA3	MS office
4.	Value Added Course	23UENVA4	Secret of Mental Math - I
5.	Value Added Course	23UMAVA5	Fundamentals of Numeracy Skills
6.	Value Added Course	23UMAVA6	Secret of Mental Math - II

**Allied Courses offered to Other Department**

S. No	Allied Course	Course Code	Course Name
1.	Computer Application, Computer Science, Information Technology and Artificial Intelligence & Machine Learning	23UMA1AC1	Numerical Methods & Statistics
		23UMA2AC2	Operations Research
2.	Physics	23UMA1AC11	Algebra and Calculus
		23UMA1AC12	Algebra and Trigonometry
		23UMA2AC21	Analytical Geometry (3D), Trigonometry and Fourier Series.
		23UMA2AC22	Analytical Geometry (3D) and Fourier Series

**Note:**

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

**FOR THEORY**

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for Semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

**FOR PRACTICAL**

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]

The passing minimum for Semester Examinations shall be 40% out of 60 marks [i.e. 24 marks]

- Project : 100 Marks (The Project will be evaluated by an Internal and an External Examiner)
  - Dissertation - 80 Marks
  - Viva Voce - 20 Marks

## Question Paper Pattern

<b>UG Programme</b>		
<b>Maximum Marks : 75</b>		<b>Duration: 3 Hours</b>
<b>Section - A</b>	<b>i) a-</b> (5 Questions for Multiple Choice) One question from each unit	5 x 1 = 5 Marks
	<b>b-</b> (5 Questions for Fill in the Blanks) One question from each unit	5 x 1 = 5 Marks
	<b>ii)</b> (5 short answer questions) One question from each unit	5 x 2 = 10 Marks
<b>Section - B</b>	<b>5 Questions</b> (Internal Choice: Either or) One set of questions from each unit	5 x 5 = 25 Marks
<b>Section - C</b>	<b>3 Questions</b> (Answer any 3 out of 5 Questions) One question from each unit	3 x 10 = 30 Marks

## SEMESTER – I

Course Code: 23UMA1CC1  
Instruction Hours: 5  
Credits: 5

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – I –ALGEBRA AND TRIGONOMETRY

#### OBJECTIVES:

- Basic ideas on the Theory of Equations, Matrices and Number Theory.
- Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Classify and Solve reciprocal equations.

**CLO 2:** Find the sum of Binomial, Exponential and Logarithmic series.

**CLO 3:** Find Inverse of Matrix, Eigen values, Eigen vectors and verify Cayley Hamilton theorem a given matrix.

**CLO 4:** Expand the powers and multiples of trigonometric functions in terms of sine and cosine.

**CLO 5:** Determine relationship between circular and hyperbolic functions

#### UNIT – I

Reciprocal Equations - Standard Form Reciprocal Equations – A reciprocal equation of the standard form can always be depressed to another of half the dimension - Increasing or decreasing the roots of a given equation – Form of the quotient & Remainder - Removal of terms.

#### UNIT – II

Binomial– Exponential – Logarithmic series (Theorems without proof) – Approximations - related problems.

#### UNIT – III

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

#### UNIT – IV

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

#### UNIT – V

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

#### TEXT BOOK(S):

1. T.K. Manickavasagam Pillai, S. Natarajan and Ganapathy, “Algebra” Volume – I 2006.
2. S. Narayanan, T.K. Manichavasagam Pillai, “Trigonometry”, S. Viswanathan (Printers& Publishers, Pvt Limited, 2010.

UNIT – I	Chapter – 6	Section 16 to 19 of [1]
UNIT – II	Chapter – 3	Section 5,6 & 10 of [1]
	Chapter – 4	section 3,5,6,7 & 14 of [1]
UNIT – III	Chapter – 5	Section 1 to 5 [1]
UNIT – IV	Chapter – 3	Section 1 to 5 of [2]
UNIT – V	Chapter – 4	Section1 to 2 of [2]

#### REFERENCE(S):

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

#### WEB LINK:

1. <https://lib.alfaisal.edu/pdf/AlgebraAndTrigonometry-LR.pdf>
2. <https://home.cs.colorado.edu/~alko5368/lecturesCSCI2820/mathbook.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UMA1CC1	ALGEBRA AND TRIGONOMETRY					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: HIGH					

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – I

Course Code: 23UMA1CC2  
Instruction Hours: 6  
Credits: 5

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – II – DIFFERENTIAL CALCULUS

#### OBJECTIVES:

- The basic skills of differentiation, successive differentiation, and their applications.
- Basic knowledge on the notions of curvature, Evolutes, involutes and polar co-ordinates and in solving related problems.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Find the  $n$ th derivative, form equations involving derivatives and apply Leibnitz formula.

**CLO 2:** Find the partial derivative and total derivative coefficient.

**CLO 3:** Determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers.

**CLO 4:** Find the envelope of a given family of curves.

**CLO 5:** Find the Evolutes and involutes and to find the radius of curvature using polar co-ordinates.

#### UNIT – I

Successive Differentiation: Introduction (Review of basic concepts) – The  $n^{th}$  derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the  $n^{th}$  derivative of a product.

#### UNIT – II

Partial Differentiation: Partial derivatives – Higher derivatives – Homogeneous functions - Function of a function rule – Total differential coefficient.

#### UNIT – III

Partial Differentiation (Continued): Implicit Functions– Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers.

#### UNIT – IV

Envelope: Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.

#### UNIT – V

Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutives – Radius of Curvature in Polar Co-ordinates.

#### TEXT BOOK(S):

1. S.Narayanan, T.K.Manicavachagam Pillai, "Differential Calculus", Volume- I, S.V.Publications, 2010.
2. Dr.P.R.vittal&Dr.V.Malini. "Calculus", Margham Publications.

UNIT – I	Chapter – 3	Sections 1.1 to 2.1 of [1]
UNIT – II	Chapter – 3	Sections 1.1 to 1.3 and 2.1 to 2.3of [2]
UNIT – III	Chapter – 3	Sections 2.4, 4 & 5 of [2]
UNIT – IV	Chapter – 10	Sections 1 to 4 of [1]
UNIT – V	Chapter – 10	Sections 2.1, 2.2, 2.5, 2.6 of [1]

#### REFERENCE(S):

1. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989.
2. T. Apostol, Calculus, Volumes I and II.
3. S. Goldberg, Calculus and mathematical analysis

**WEB LINK:**

1. <https://3lihandam69.files.wordpress.com/2018/10/calculus-10th-edition-anton.pdf>
2. <http://www.sufwan.com/wp-content/uploads/CalculusAndAnalyticalGeometry/Calculus-Book-Thomas-Finney.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UMA1CC2	DIFFERENTIAL CALCULUS					6	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: HIGH					

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – II

Course Code: 23UMA2CC3

Instruction Hours: 5

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – III – ANALYTICAL GEOMETRY (3D) AND FOURIER SERIES

#### OBJECTIVES:

- Necessary skills to analyse characteristics and properties of two- and three-dimensional geometric shapes.
- To present mathematical arguments about geometric relationships.
- To solve real world problems on geometry and its applications.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO1:** Explain in detail the system of Planes.

**CLO2:** Understand the system of Straight lines.

**CLO3:** Analyse in detail the system of Spheres.

**CLO4:** Find the Fourier coefficient for the period  $2\pi$ .

**CLO5:** Apply the knowledge of Fourier functions.

#### UNIT-I:

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

#### UNIT-II:

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

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

#### UNIT-III:

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

#### UNIT-IV:

Definition of Fourier series – Finding Fourier Coefficients for a given periodic function with period  $2\pi$ .

#### UNIT-V:

Even and Odd functions – Half Range Fourier Series – Development on Cosine series – Development in Sine series.

#### TEXT BOOK(S):

1. T.K. Manickavachagom Pillai and T. Natarajan. A Text Book of Analytical Geometry (Part II-Three Dimensions) Viswanathan (Printers & Publishers) Pvt. Ltd.
2. S.Narayanan, T.K. Manichavasagam Pillai, “Calculus” Volume – III, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011.

Unit I	Chapter – 2	Sections 1 to 11 of [1]
Unit II	Chapter – 3	Sections 1 to 8 & 10 of [1]
Unit III	Chapter – 4	Sections 1 to 8 of [1]
Unit IV	Chapter – 5	Sections 1 to 2 of [2]
Unit V	Chapter – 5	Sections 3 to 4 of [2]

#### REFERENCE(S):

1. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions.
2. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016.

3. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9<sup>th</sup> Edition, 2010.
4. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961.
5. Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, Cengage Learning, CA, USA, 2010.
6. William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc, New York, 2006.

**WEB LINK:**

1. <https://ia800504.us.archive.org/11/items/elementsofcoordi00lone/elementsofcoordi00lone.pdf>
2. [https://www.forgottenbooks.com/en/download/An Elementary Treatise on Coordinate Geometry of Three Dimensions 1000038010.pdf](https://www.forgottenbooks.com/en/download/An_Elementary_Treatise_on_Coordinate_Geometry_of_Three_Dimensions_1000038010.pdf)
3. <https://nptel.ac.in>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMA2CC3	ANALYTICAL GEOMETRY OF THREE DIMENSIONS					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>					

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – II

Course Code: 23UMA2CC4  
Instruction Hours: 5  
Credits: 5

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – IV – INTEGRAL CALCULUS

#### OBJECTIVES:

- Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
- Knowledge about Beta and Gamma functions and their applications.
- Skills to Determine Multiple Integrals.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.

**CLO 2:** Explain Geometric applications of integral calculus

**CLO 3:** Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution

**CLO 4:** Evaluate double and triple integrals and problems using change of order of integration.

**CLO 5:** Explain Beta and Gamma functions and to use them in solving problems of integration.

#### UNIT I

Reduction formulae –Types -Integration of product of powers of algebraic and trigonometric functions -Integration of product of powers of algebraic and logarithmic functions - Bernoulli's formula.

#### UNIT II

##### Geometric Applications of Integration: -

Area under plane curve – Cartesian coordinates – Area of a closed curve and Examples – Area in polar coordinates.

#### UNIT III

**Multiple Integrals:** Definition of double integrals - Evaluation of double integrals – Double integrals in polar coordinates - Change of order of integration.

#### UNIT IV

Triple integrals – Applications of multiple integrals - Volumes of solids of revolution - Areas of curved surfaces.

#### UNIT V

Beta and Gamma functions –Definitions–Convergent of Gamma n - Recurrence formula of Gamma functions – properties of Beta functions- Relation between Beta and Gamma functions – Applications of Gamma function to Multiple Integral.

#### TEXT BOOK(S):

1. S.Narayanan, T.K.Manicavachagom Pillai, “ Calculus, Volume II, S.V.Publications,.

UNIT – I	Chapter – 1	Sections 13 to 15.1
UNIT – II	Chapter – 2	Sections 1.1 to 1.4
UNIT – III	Chapter – 5	Section 1 to 3.2
UNIT – IV	Chapter – 5	Sections 4 to 7
UNIT – V	Chapter – 7	Sections 2 to 6

#### REFERENCE(S):

1. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd.
2. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001 (second edition).

**WEB LINK:**

1. <https://3lihandam69.files.wordpress.com/2018/10/calculus-10th-edition-anton.pdf>
2. <http://www.sufwan.com/wp-content/uploads/CalculusAndAnalyticalGeometry/Calculus-Book-Thomas-Finney.pdf>

## Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMA2CC4	INTEGRAL CALCULUS					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = <b>37</b>						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – II

Course Code: 23UMA2SE3  
Instruction Hours: 2  
Credits: 2

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### SKILL ENHANCEMENT COURSE – 3 COMPUTATIONAL MATHEMATICS

#### OBJECTIVE:

- To learn the problem solving techniques for aptitude problems.
- To enable the students prepare themselves for various competitive examinations.

#### COURSE OUTCOMES

**CLO1:** Understand the concept of HCF, LCM.

**CLO2:** Developing problem solving skills of Permutations and Combinations.

**CLO3:** Solve the problems based on ratio & Proportion.

**CLO4:** Identify the short cut of solving percentage problems.

**CLO5:** Implement the idea to finding ages.

#### UNIT – I

HCF and LCM of Numbers.

#### UNIT – II

Permutations and Combinations.

#### UNIT – III

Ratio and Proportion.

#### UNIT – IV

Percentage.

#### UNIT – V

Problems on Ages.

#### TEXT BOOK:

1. R.V.Praveen, Quantitative Aptitude and Reasoning, Phi Learning, New Delhi, 2nd Edition-2013.

UNIT – I	Chapter – 1
UNIT – II	Chapter – 2
UNIT – III	Chapter – 4
UNIT – IV	Chapter – 5
UNIT – V	Chapter – 7

#### REFERENCE(S):

1. R.S. Aggarwal, Arithmetic (Subjective and Objective) For Competitive Examinations, S.Chand and Company Ltd. 2004.
2. R.S. Aggarwal, Objective Arithmetic, S. Chand & Company Ltd. 2004.

#### Web link

1. <https://comparekro.in/sscbooks/s3.pdf>
2. <https://sucessguru.com/objective-arithmetic-for-competitive-examinations-pdf/>
3. <https://www.pdfdrive.com/fast-track-objective-arithmetic-e85018060.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMA2SE3	COMPUTATIONAL MATHEMATICS					2	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1		✓	✓	✓	✓		✓	✓	✓		
CO2	✓	✓	✓	✓	✓		✓	✓	✓		
CO3	✓			✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches (✓) = <b>39</b>						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – III

Course Code: 23UMA3CC5

Instruction Hours: 5

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – V – VECTOR CALCULUS AND APPLICATIONS

#### OBJECTIVES:

- Knowledge about differentiation of vectors and on differential operators. Knowledge about derivatives of vector functions.
- Skills in evaluating line, surface and volume integrals.
- The ability to analyse the physical applications of derivatives of vectors.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Find the derivative of vector and sum of vectors, Theorems of differentiation and to Determine Partial derivatives.

**CLO 2:** Applications of the operator ‘del’ and to Explain solenoidal and ir-rotational vectors.

**CLO 3:** Solve simple line integrals.

**CLO 4:** Solve surface integrals and volume integrals.

**CLO 5:** Verify the theorems of Gauss, Stoke’s and Green’s Theorem.

#### UNIT I

Differentiation of a Vector functions of single variables – Theorems of differentiation–Constant vector – Vector Integration – Partial Derivatives.

#### UNIT II

The vector differential Operator ‘del’, -The Operator  $\nabla$  - The gradient of a scalar point function - Divergence and Curl of a vector - Solenoidal and irrotational vectors – Simple applications

#### UNIT III

The Laplacian operator  $\nabla^2$  - Line integral - Simple problems

#### UNIT IV

Normal Surface Integral -Flux across a surface -Volume integral – Simple Problems.

#### UNIT V

Gauss divergence Theorem - Stoke’s Theorem - Green’s Theorem - Stoke’s Theorem in space – Stoke’s Theorem in Cartesian forms.

#### TEXT BOOK(S):

1. M.L. Khanna, Vector Calculus – Jai Prakash North and Co 1997.

UNIT – I Chapter – 1 Sections 1 to 5

UNIT – II Chapter – 2 Sections 2, 3, 4, 7.

UNIT – III Chapter – 2 Section 9

Chapter – 3 Section 1

UNIT – IV Chapter – 3 Sections 2, 3, 4.

UNIT – V Chapter – 3 Sections 5 to 8

#### REFERENCE(S):

1. J.E. Marsden and A. Tromba, Vector Calculus, (5<sup>th</sup>edn.) W.H. Freeman, New York, 1988.
2. J.C. Susan, Vector Calculus, (4<sup>th</sup> Edn.) Pearson Education, Boston, 2012.
3. A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014

#### WEB LINK:

1. [https://www.u-cursos.cl/ciencias/2015/1/MC-330/1/material\\_docente/bajar?id\\_material=1082333](https://www.u-cursos.cl/ciencias/2015/1/MC-330/1/material_docente/bajar?id_material=1082333)

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	23UMA3CC5	VECTOR CALCULUS AND APPLICATIONS					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – III

Course Code: 23UMA3CC6

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – VI – ELEMENTS OF MATHEMATICAL ANALYSIS

#### OBJECTIVES:

- Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series.
- Understand metric spaces with suitable examples.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Explain in detail about sets and functions, equivalence and accountability and the LUB axiom

**CLO 2:** Explain Sequence and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent, bounded and monotone sequences

**CLO 3:** Explain the operations on convergent and divergent sequences and to Explain the concepts of limit superior and limit inferior and the notion of Cauchy sequences

**CLO 4:** Classify the series of real numbers and the alternating series and their convergence and divergence, the conditional convergence and absolute convergence and solve problems on convergence of the sequences

**CLO 5:** Explain about the metric spaces and functions continuous on a Metric space.

#### UNIT I

**Sets and Functions:** Sets and elements - Operations on sets –Functions- Real valued functions – Equivalence- Count ability- Real numbers- least upper bounds.

#### UNIT II

**Sequences of Real Numbers:** Definition of a sequence and subsequence-limit of a sequence – Convergent sequences–divergent sequences- bounded sequences-monotone sequences

#### UNIT III

Operations on convergent sequences – Operations on divergent sequences – limit superior and limit inferior-Cauchy sequences.

#### UNIT IV

**Series of Real Numbers:** Convergence and divergence – Series with non –negative terms-alternating series-conditional convergence and absolute convergence - Tests for absolute convergence.

#### UNIT V

**Limits and Metric Spaces:** Limit of a function on the real line - Metric spaces - Limits in metric spaces.

**Continuous Functions on Metric Spaces:** Function continuous at a point on the real line-Function continuous on a metric space.

#### TEXT BOOK(S):

1. Richard R. Goldberg, Methods of Real Analysis: Oxford and IBH Publishing, (1 January 2020).

UNIT – I	Chapter – 1	Sections 1.1 to1.7
UNIT – II	Chapter – 2	Sections 2.1 to 2.6.
UNIT – III	Chapter – 2	Sections2.7 to 2.10
UNIT – IV	Chapter – 3	Sections 3.1 to 3.4, 3.6.
UNIT – V	Chapter – 4	Sections 4.1 to 4.3
	Chapter–5	sections 5.1 and 5.3

#### REFERENCE(S):

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3. Ethan D. Bloch, The Real Numbers and Real Analysis, Springer, 2011.
4. G.M. The fundamentals of Mathematical Analysis, vol I. Pergamon Press, New York, 1965.

**WEB LINK:**

1. <https://alansinyal.files.wordpress.com/2012/08/method-of-real-analysis.pdf>
2. <https://web.math.ucsb.edu/~agboola/teaching/2021/winter/122A/rudin.pdf>

## Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
III	23UMA3CC6	ELEMENTS OF MATHEMATICAL ANALYSIS					5	4				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2	✓		✓	✓	✓	✓		✓				
CO3	✓		✓				✓	✓	✓	✓		
CO4		✓		✓	✓	✓	✓	✓	✓	✓		
CO5	✓	✓	✓	✓	✓	✓	✓					
Number of Matches (✓) = <b>37</b>						Relationship: <b>HIGH</b>						

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – III

Course Code: 23UMA3AC2

Instruction Hours: 5

Credits: 3

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### ALLIED COURSE – III – MATHEMATICAL STATISTICS

#### OBJECTIVES:

- Knowledge about the methods of solving Ordinary and Partial Differential Equations.
- The understanding of how Differential Equations can be used as a powerful tool in solving problems in science.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Calculate Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean.

**CLO 2:** Find the solutions of equations the dispersions.

**CLO 3:** Understand the concept of Correlation.

**CLO 4:** Gain the Knowledge of Regression.

**CLO 5:** To be able to deduce statistical inference of a data through sampling techniques Understand Student's t-test of Difference of means.

#### UNIT – I

**Statistical data:** Introduction– Frequency distribution - Graphic representation of a frequency distribution -Measures of Central Tendency – Mean –Median – Mode - Geometric mean - Harmonic mean (simple problems only).

#### UNIT – II

**Measures of dispersion:** Range - Quartile deviation- Mean deviation - Standard deviation – Coefficient of dispersion.

#### UNIT III

**Correlation:** Introduction – Meaning of Correlation – Scatter Diagram – Karl Pearson's coefficient of correlation – Rank correlation.

#### UNIT IV

**Regression:** Introduction – Linear regression – curvilinear regression – Simple Problems.

#### UNIT V

**Application of t-distribution:** t-test for Single Mean – t-test for Difference of Means -

#### TEXT BOOK(S):

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2011, Sultan Chand & Sons publications, New Delhi.

UNIT – I	Chapter – 2	Sections 2.1 to 2.9
UNIT – II	Chapter – 2	Sections 2.13 to 2.14
UNIT – III	Chapter – 10	Sections 10.1 to 10.4.1, 10.4.2, 10.7.2.
UNIT – IV	Chapter – 11	Sections 11.1 to 11.3
UNIT – V	Chapter – 16	Sections 16.3 to 16.3.3

#### REFERENCE(S):

1. S.P. Gupta, Statistical Methods, Revised Edition, 2001.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.

#### WEB LINK:

1. [https://books.google.co.in/books?id=FmuH3IcYIRYC&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=true](https://books.google.co.in/books?id=FmuH3IcYIRYC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=true)
2. <https://www.pdfdrive.com/statistics-601-advanced-statistical-methods-e387419.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	23UMA3AC2	MATHEMATICAL STATISTICS					5	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – III

Course Code: 23UMA3SE4

Instruction Hours: 2

Credits: 2

Exam Hours: 3

Internal Marks:40

External Marks: 60

### SKILL ENHANCEMENT COURSE IV

#### STATISTICAL FUNCTIONS IN EXCEL (ENTREPRENEURIAL SKILL) – PRACTICAL

##### OBJECTIVES

- To provide concepts used in routines in Statistical Functions in the Excel.
- To acquire the knowledge of using Excel.

##### COURSE OUTCOMES

- To analyze numerical data to make informed decisions.
- To perform various statistical calculations on data.
- To understand intermediate statistical function in excel.
- To apply the concept of variability functions.

##### LIST OF PRACTICAL:

###### 1. Basic statistical Function

These include the COUNT function, COUNTA function, COUNTBLANK function, COUNTIFS function.

###### 2. Graphical Data Representation

Creating Pie Charts, Bar Charts, Frequency Histogram, and Line diagram.

###### 3. Intermediate Statistical Function

Measures of Central Tendency: AVERAGE (MEAN) function, MEDIAN function, MODE function,  
Measures of Variability: RANGE function, STANDARD DEVIATION function, VARIANCE function, QUANTILES function, CORRELATION function, MAX function, MIN function, LARGE function, SMALL function

##### Web link:

1. <https://www.geeksforgeeks.org/statistical-functions-in-excel-with-examples/>
2. <https://www.upgrad.com/blog/15-statistical-functions-in-microsoft-excel/>
3. <https://egyankosh.ac.in/bitstream/123456789/67023/3/Unit-17.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	23UMA3SE4	STATISTICAL FUNCTIONS IN EXCEL(Entrepreneurial Skill) - PRACTICAL					2	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1		✓	✓	✓	✓		✓	✓	✓		
CO2	✓	✓	✓	✓	✓		✓	✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches (✓) = 41						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – IV

Course Code: 23UMA4CC7

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – VII – INDUSTRY MODULE – OPTIMIZATION TECHNIQUES

#### OBJECTIVES:

- To bridge the gap between industries academia interface.
- To apply the theory learnt to industrial applications.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Illustrate General Linear Programming Problem by Simplex Method of LPP.

**CLO 2:** Find Initial Basic Feasible Solution to the Transportation Problem by using North West Corner Rule, Matrix Minima Method and VAM –MODI Method.

**CLO 3:** Understand various method of solving Assignment problems.

**CLO 4:** Become familiar with various terms and rules used in theory of games.

**CLO 5:** Illustrate basic components of Network and critical path.

#### UNIT – I

**Linear Programming Problem:** Introduction -Mathematical formulation of LPP – Graphical Method - Simplex Method –Uses of Artificial variable.

#### UNIT – II

**Transportation Problem:** Introduction – Linear programming Formulation of the Transportation Problem – Finding an Initial Basic Feasible Solution – Test for Optimality – Economic Interpretation of  $u_i$ 's and  $v_j$ 's – Degeneracy in Transportation Problem –Transportation Algorithm (MODI Method) – Unbalanced Transportation Problem.

#### UNIT – III-

**Assignment Problem:** Introduction - Mathematical Formulation of the Problem- Solution method of Assignment Problem – Special cases in Assignment Problem - Travelling Salesman Problem - Unbalance Assignment Problem.

#### UNIT –IV

**Games and Strategies:** Introduction - Two Person Zero Sum Games - Sum Basic terms - The Maximin - Minimax Principle - Games without Saddle Points - Mixed Strategies - Graphical Solution of  $2 \times n$  and  $m \times 2$  games - Dominance Property.

#### UNIT – V

**Network Scheduling by PERT / CPM:** Introduction - Network; Basic components –Logical sequencing - Rules of Network Construction – Concurrent activities - Critical Path Analysis– Probability consideration in PERT.

#### TEXT BOOK:

1. KantiSwaroop, Gupta.P.K,&Manmohan, Operations Research, Sultan Chand & Co, 16<sup>th</sup>Revised Edition.

UNIT – I	Chapter – 2	Sections 2.1 to 2.4
	Chapter – 3& 4	Section 3.2 & 4.3, 4.4
UNIT – II	Chapter – 10	Sections 10.1, 10.2 and 10.9 to 10.13, 10.15
UNIT – III	Chapter – 11	Section 11.1 to 11.4 and 11.7
UNIT – IV	Chapter –17	Section 17.1 to 17.7
UNIT – V	Chapter – 25	Section 25.1 to 25.7

#### REFERENCE(S):

1. Hamdy A. Taha, Operations Research, 7<sup>th</sup> Edition, Prentice Hall of India, 2002
2. Gupta.P.K.and D.S. Hira – Operations Research - S.Chand and Company.

**Web Link:**

1. <https://www.pdfdrive.com/operations-research-an-introduction-e33409273.html>
2. <https://www.pdfdrive.com/operations-research-e176219303.html>

## Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	23UMA4CC7	OPTIMIZATION TECHNIQUES					6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓			✓	✓		✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO4		✓	✓	✓		✓	✓	✓	✓		
CO5		✓	✓	✓	✓	✓	✓	✓	✓		
Number of Matches(✓) = <b>40</b> Relationship: <b>HIGH</b>											

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – IV

Course Code: 23UMA4CC8

Instruction Hours: 5

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – VI – DIFFERENTIAL EQUATIONS AND APPLICATIONS

#### OBJECTIVES:

- Knowledge about the methods of solving Ordinary and Partial Differential Equations.
- The understanding of how Differential Equations can be used as a powerful tool in solving problems in science.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables, solve Bernoulli's equations and exact differential equations

**CLO 2:** Find the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic, exponential, trigonometric functions and their products

**CLO 3:** Find solutions of simultaneous linear differential equations, linear equations of second order and to find solutions using the method of variations of parameters

**CLO 4:** Form a PDE by eliminating arbitrary constants and arbitrary functions, find complete, singular and general integrals, to solve Lagrange's equations

**CLO 5:** Explain standard forms and Solve Differential equations using Charpit's method

#### UNIT – I

**Equations of the first order and of the first degree:** Variableseparable - Homogeneous Equation-Non-Homogeneous Equations of first degree in x and y - Linear Equation - Bernoulli's Equation-Exact differential equations.

#### UNIT – II

**Equation of first order but of higher degree:** Equation solvable for  $dy/dx$ - Equation solvable for y-Equation solvable for x- Clairauts' form –Equation that do not contain x explicitly.

#### UNIT – III

**Linear Equations with constant coefficient:** Definitions – The operator D – The Complementary function of a linear equation with constant – Particular Integral – General method of finding Particular Integral – Special method of finding Particular Integral.

#### UNIT – IV

**Linear Equations of the Second Order:** Complete solution in terms of a known integrals -Reduction to the Normal form - Change of the Independent Variable - Method of Variation of Parameters

#### UNIT –V

Classification of integral – Singular Integral – General Integral – Derivation of PDE – By elimination of constant – By elimination of arbitrary function – Lagrange's method of solving the linear equations.

#### TEXT BOOK(S):

1. S. Narayanan & T. K. Manichavasagam Pillai, "Differential Equations and its Applications" S. Viswanathan Publisher Pvt. Ltd., 2011.

UNIT – I	Chapter – 2	Sections 1 to 6.1
UNIT – II	Chapter – 4	Sections 1 to 4
UNIT – III	Chapter – 5	Sections 1 to 4
UNIT – IV	Chapter – 8	Sections 1 to 4
UNIT – V	Chapter – 12	Sections1 to 4

#### REFERENCE(S):

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. G.F. Simmons, Differential equations with applications and historical notes, 2<sup>nd</sup>Ed, Tata Mcgraw Hill Publications, 1991.

**WEB LINK:**

1. <https://ia801500.us.archive.org/33/items/DifferentialEquations3rdEditionShepleyL.Ross/Differential%20equations%203rd%20edition%20Shepley%20L.Ross.pdf>
2. <https://www.iitg.ac.in/jiten/Extra/Sneddon.pdf>
3. <https://dokumen.tips/download/link/george-f-simmons-differential-equations-with-applications-and-historical-notes.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	23UMA4CC8	DIFFERENTIAL EQUATIONS AND APPLICATIONS					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – IV

Course Code: 23UMA4AP2  
Instruction Hours: 3  
Credits: 3

Exam Hours: 3  
Internal Mark: 40  
External Marks: 60

### ALLIED PRACTICAL– II MATHEMATICAL STATISTICS – PRACTICAL

#### OBJECTIVES:

- To apply the basic ideas of statistical data's.
- To deduce statistical inference of a data through sampling techniques.

#### COURSE OUTCOMES:

**CLO 1:** Problem solving skills of students are enhanced.

**CLO 2:** Theoretical concepts are strengthened by solving maximum no. of problems

**CLO 3:** Due to one to one interaction with the teacher doubts of the students get cleared if any.

**CLO 4:** Students learn how to apply mathematical concepts to practical and real life problems.

**CLO 5:** Interdisciplinary approach is developed.

#### UNIT –I

Formation of frequency distribution - **Measures of central tendency:** Mean – Median –Mode - Geometric mean - Harmonic mean.

#### UNIT – II

**Measures of dispersion:** Range -Quartile deviation - Mean deviation - Standard deviation – Coefficient of variation - Measures of Skewness and kurtosis.

#### UNIT – III

Calculation of Karl Pearson's coefficient of Correlation–Spearman's Rank correlation and Regression Equations.

#### UNIT – IV

One tailed and two tailed test – Exact Sample test-  $t^2$ -Test for single mean - Difference between means - paired  $t$  – test.

#### UNIT – V

Large sample tests – Test of single mean - Difference between means – single Proportion and Difference between Proportion –Chi square test for goodness of fit and Independence of Attributes.

#### TEXT BOOK:

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition: 2011, Sultan Chand & Sons publications, New Delhi.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.

#### Web Link:

1. <http://dcpehvpm.org/E-Content/Stat/FUNDAMENTAL%20OF%20MATHEMATICAL%20STATISTICS-S%20C%20GUPTA%20&%20V%20K%20KAPOOR.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	23UMA4AP2	MATHEMATICAL STATISTICS - PRACTICAL					3	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓						✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓						
CO4	✓				✓	✓	✓	✓	✓	✓	
CO5	✓		✓	✓	✓	✓	✓	✓	✓		
Number of Matches(✓) = <b>35</b>						Relationship: <b>HIGH</b>					

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – V

Course Code: 23UMA5CC9

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – IX – ABSTRACT ALGEBRA

#### OBJECTIVES:

- To understand various algebraic structures including sets, groups, rings and vector spaces and their properties.
- To identify different algebraic structures, isomorphic and non-isomorphic structure

#### COURSE OUTCOMES:

On completion of the course, the student will be able to

**CLO1:**Recognize the mathematical objects called groups.

**CLO2:**Find cycles, Order of an element and Cosets.

**CLO3:**Explain the significance of the notions of normal subgroups, and Cayley's Theorem.

**CLO4:**Gains knowledge in Ring theory.

**CLO5:**Learn the construction of field of quotients of an integral domain.

#### UNIT – I

**Groups:**Definition and Examples – Elementary Properties of Groups - Equivalent definitions of a group - Permutation groups – Subgroup.

#### UNIT – II

**Cyclic Group:** Cyclic groups– Number of generators of a cyclic group – Order of an element –Cosets – Cosets and Lagrange's theorem – Euler's theorem – Fermat's theorem.

#### UNIT – III

**Normal subgroup:**Normal subgroups and Quotient groups – Isomorphism – Homomorphism.

#### UNIT – IV

**Rings:** Definition and examples – Elementary properties of a ring –Isomorphism–Types of rings– Characteristic of a ring– Sub rings.

#### UNIT – V

**Rings (Continued):**Ideals –Quotient Ring - Maximal and prime Ideals–Homomorphisms of Rings – Field of quotients of Integral domain – Ordered Integral domain.

#### TEXT BOOK:

1. S. Arumugam and A. Thangapandi Isaac, Modern Algebra, Scitech Publications (India) Pvt. Ltd. 2003.

UNIT –I	Chapter – 3	Sections 3.1 to 3.5
UNIT –II	Chapter –3	Sections 3.6 to 3.8
UNIT –III	Chapter –3	Sections 3.9 to 3.11
UNIT –IV	Chapter– 4	Sections 4.1 to 4.6
UNIT –V	Chapter –4	Sections 4.7 to 4.12

#### REFERENCE(S):

1. M.L. Santiago, Modern Algebra, Arul Publications, 1993.
2. S.G. Venkatachalapathy, Modern Algebra, Maragham Publications, 2003.

#### Web Link:

1. <https://www.pdfdrive.com/a-history-of-abstract-algebra-from-algebraic-equations-to-modern-algebra-e184663837.html>
2. <https://mathcs.clarku.edu/~djoyce/ma225/algebra.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	23UMA5CC9	ABSTRACT ALGEBRA					6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓						✓	
CO3	✓			✓	✓	✓	✓	✓	✓	✓	
CO4	✓			✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓		✓	✓	✓	✓			
Number of Matches (✓) = <b>38</b>						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – V

Course Code: 23UMA5CC10  
Instruction Hours: 6  
Credits: 4

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – X – REAL ANALYSIS

#### OBJECTIVES:

- Real Numbers and properties of Real-valued functions.
- Connectedness, Compactness, Completeness of Metric spaces.
- Convergence of sequences of functions, Examples and counter examples.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Explain the concepts of Continuous and Discontinuous functions, open and close sets, Connectedness, Completeness and Compactness.

**CLO 2:** Explain the concepts of bounded and totally bounded sets, continuity of inverse functions and Uniform continuity.

**CLO 3:** Define the sets of measure zero, to Explain about the existence and properties of Riemann integral.

**CLO 4:** Explain the concept of differentiability and to Explain Rolle's theorem, Law of mean, and Fundamental theorem of calculus.

**CLO 5:** Explain the point wise and uniform convergence of sequence of function and to derive the Taylor's theorem.

#### UNIT I

**Continuous Functions on Metric Spaces:** Open sets– closed sets–Discontinuous function on  $\mathbb{R}^1$ .

**Connectedness, Completeness and Compactness:** More about open sets-Connected sets.

#### UNIT II

**Connectedness, Completeness and Compactness (Continued):**Bounded sets and totally bounded sets - Complete metric spaces - Compact metric spaces - Continuous functions on a compact metric space - Continuity of inverse functions - Uniform continuity.

#### UNIT III

**Calculus:** Sets of measure zero - Definition of the Riemann integral - Existence of the Riemann integral- Properties of the Riemann integral.

#### UNIT IV

**Calculus (Continued):** Derivatives - Rolle's theorem – The Law of the mean - Fundamental theorems of calculus.

#### UNIT V

**The Elementary function:**Taylor's Theorem-Point wise convergence of sequences of functions - uniform convergence of sequences of functions.

#### TEXT BOOK(S):

1. Richard R.Goldberg, Methods of Real Analysis- (John Wiley & sons, 2<sup>nd</sup> edition) (Indian edition –Oxford and IBH Publishing Co, New Delhi, 1<sup>st</sup> January 2020)

UNIT – I	Chapter – 5 & 6	Sections 5.4 to 5.6 & 6.1, 6.2
UNIT – II	Chapter – 6	Sections 6.3 to 6.8
UNIT – III	Chapter –7	Sections 7.1 to 7.4
UNIT – IV	Chapter– 7	Sections 7.5 to 7.8
UNIT – V	Chapter – 8 & 9	Sections 8.5& 9.1, 9.2

#### REFERENCE(S):

1. Principles of Mathematical Analysis by Walter Rudin, Tata McGraw Hill Education, Third edition (1 July 2017).

2. Mathematical Analysis Tom M A postal, Narosa Publishing House, 2<sup>nd</sup> edition (1974), Addison-Wesley publishing company, New Delhi.

**WEB LINK:**

1. <https://alansinyal.files.wordpress.com/2012/08/method-of-real-analysis.pdf>
2. <https://web.math.ucsb.edu/~agboola/teaching/2021/winter/122A/rudin.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	23UMA5CC10	REAL ANALYSIS					6	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = <b>37</b>						Relationship: <b>HIGH</b>					

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – V

Course Code: 23UMA5CC11  
Instruction Hours: 5  
Credits: 4

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – XI – STATICS

#### OBJECTIVES:

- To provide the basic knowledge of equilibrium of a particle.
- To develop a working knowledge to handle practical problems.

#### COURSE OUTCOMES:

On completion of the course, the student will be able to

**CLO1:**Gains knowledge about the nature of forces.

**CLO2:**Acquire knowledge regarding the objects at rest.

**CLO3:**Be aware of friction and its various forms.

**CLO4:**Be familiar with centre of gravity.

**CLO5:**Explain Types of forces and Equilibrium of a uniform homogeneous string.

#### UNIT – I

**Forces acting on a particle:** Forces -Types of forces -Equilibrium of two forces - Lami's theorem - Polygon law of forces -Moment of a force about a point and a line -Parallel forces - Varignon's theorem.

#### UNIT – II

**Forces acting on a rigid body:** Equilibrium of three forces acting on a rigid body – Three coplanar forces – Conditions of equilibrium – Two trigonometrical theorems.

#### UNIT – III

Reduction of coplanar forces – Change of the base point – Equation to the line of action resultant – Conditions of equilibrium of a system of coplanar forces.

#### UNIT – IV

**Friction:** Friction - Laws of friction - Angle of friction - Cone of friction - Conditions for sliding and toppling.

#### UNIT – V

**Equilibrium of Strings and Chains:** Equilibrium of strings and chains - Common catenary -suspension bridge.

#### TEXT BOOK:

1. M.K.Venkataraman, Statics, Agasthiyar Publications, 14<sup>th</sup> Edition. 2011.

UNIT – I	Chapter – 1	Sections 2 to 5
	Chapter – 2 & 3	Sections 1 to 9 & 1 to 12
UNIT – II	Chapters – 5	Sections 1 to 6
UNIT – III	Chapter – 6	Sections 1 to 10
UNIT – IV	Chapter – 7	Sections 1 to 13
UNIT – V	Chapter – 11	Sections 1 to 9

#### REFERENCE(S):

1. ViswanathaNaik, K and M.S. Kasi – Statics – Emerald Publishers.

2. P.Duraipandian, LaxmiDuraipandian and MuthamizhJayapragasam, Mechanics S.Chand& Company PVT, LTD, 2014.

**Web Link:**

1. [https://www.kngac.ac.in/elearning-portal/ec/admin/contents/4\\_18K5M10\\_2020111802531868.pdf](https://www.kngac.ac.in/elearning-portal/ec/admin/contents/4_18K5M10_2020111802531868.pdf)
2. [http://162.241.27.72/siteAdmin/dde-admin/uploads/3/UG\\_B.Sc.\\_Mathematics\\_11334-Mechanics.pdf](http://162.241.27.72/siteAdmin/dde-admin/uploads/3/UG_B.Sc._Mathematics_11334-Mechanics.pdf)

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	23UMA5CC11	STATICS					5	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓			✓	✓	✓	✓			✓	
CO3	✓			✓	✓	✓	✓			✓	
CO4	✓	✓	✓	✓	✓	✓				✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = <b>39</b>						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – V

Course Code: 23UMA5DE1

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### DISCIPLINE SPECIFIC ELECTIVE COURSE-I

#### LAPLACE AND FOURIER TRANSFORMS

##### OBJECTIVES:

- To understand the knowledge about the sequence and series.
- To acquire the knowledge of problem solving ability in summation of series and recurrence series.

##### COURSE LEARNING OUTCOME:

Students will be able to

**CLO1:** Explain the concepts of Sufficient condition for the existence of the Laplace Transforms, Laplace Transform of periodic functions and Some General Theorems

**CLO2:** Explain the concepts continuity of inverse functions and Inverse Transforms of functions.

**CLO3:** To Explain about the Solution of ODE with constant coefficients, Solution of Simultaneous Ordinary Differential Equations and Solution of differential Equations with variable coefficients.

**CLO4:** Explain the concept of Fourier Transform or complex Fourier Transform and Inversion Theorem for Complex Fourier Transform Fourier sine Transform

**CLO5:** Explain the The Convolution of falting theorem for Fourier Transform and Parseval's Identity for Fourier Transform.

##### UNIT – I

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

##### UNIT – II

**Laplace Transforms (Continued):** Inverse Laplace Transforms- Inverse Transforms of functions – Related problems.

##### UNIT – III

**Laplace Transforms (Continued):** Application of Laplace Transforms-Solution of ODE with constant coefficients –Solution of Simultaneous Ordinary Differential Equations - Solution of differential Equations with variable coefficients.

##### UNIT – IV

**Fourier Transforms:** Dirichlet's Conditions - Fourier Series – Fourier Integral formula – Fourier Transform or complex Fourier Transform - Inversion Theorem for Complex Fourier Transform Fourier sine Transform - Fourier cosine Transform –Integral formula for Fourier cosine Transform.

##### UNIT – V

**Fourier Transforms (Continued):**Linearity Properties of Fourier Transform –Change of scale property – Shifting property – Modulation Theorem – Theorem – Examples - Multiple Fourier Transforms – Convolution – The Convolution of falting theorem for Fourier Transform - Parseval's Identity for Fourier Transform.

##### TEXT BOOK(S):

1. S. Narayanan, T.K. Manicavachagam Pillai,, Calculus , Vol. III, S. Viswanathan Pvt. Limited, Chennai, 2011.
2. Vasishtha, Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2008.

UNIT – I	Chapter – 5	Sections 1 to 5 (1)
UNIT – II	Chapter – 5	Sections 6, 7 (1)
UNIT – III	Chapter – 3	Sections 3.1 to 3.3 (2)
UNIT – IV	Chapter – 6	Sections 6.1 to 6.9 (2)
UNIT – V	Chapter – 6	Sections 6.10 to 6.19 (2)

**REFERENCE(S):**

1. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Laplace Transforms, McGraw Hill, 1965.

**WEB LINK:**

1. [https://sist.sathyabama.ac.in/sist\\_coursematerial/uploads/SMTA1306.pdf](https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMTA1306.pdf)
2. <https://physics.puchd.ac.in/kuldeep/mp1/Arfken-Weber-6e-Chap15.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	23UMA5DE1	LAPLACE AND FOURIER TRANSFORMS					4	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓		✓			
CO3	✓		✓				✓	✓	✓	✓	
CO4		✓		✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓				
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>					

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – V

Course Code: 23UMA5DE2

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### DISCIPLINE SPECIFIC ELECTIVE COURSE – II DISCRETE MATHEMATICS

#### OBJECTIVES:

- To enrich the knowledge in the field of functions.
- To study the concepts of Boolean algebra and the normal forms.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Understand the concepts of mathematical logics such as connections, concept of tautology, etc.,

**CLO 2:** Gains knowledge in disjunctive and conjunctive normal forms

**CLO 3:** Study the concepts of predicate calculus and Theory of Inference for the predicate calculus.

**CLO 4:** Learn about lattices and their types.

**CLO 5:** Understand Boolean algebra and Boolean functions.

#### UNIT – I

**Mathematica Logic:** Statement and notation - Connectives – Negation – Conjunction – Disjunction – Statement Formulae and Truth tables – Conditional and Bi conditional statements – Well defined formulae – Tautologies– Equivalence of formulas – Duality law.

#### UNIT – II

**Normal forms:** Disjunctive Normal forms – Conjunctive Normal forms – Principal Disjunctive Normal forms- Principal Conjunctive Normal forms - Ordering and uniqueness of Normal forms.

#### UNIT – III

Predicate Calculus–Predicates – The statement Function, Variables and Quantifiers – Predicate formulas – Free and Bound variables – The Universe of Discourse - Inference theory of the predicate calculus – Theory of Inference for the predicate calculus – Formulas Involving more than one quantifies.

#### UNIT – IV

**Lattices:** Definition and Examples - Some properties of lattices – Lattices as algebraic systems – Sub lattice, Direct product and homomorphism – Some special lattices.

#### UNIT – V

**Boolean Algebra:** Definition and Example – Sub algebra, Direct Product and Homomorphism - **Boolean functions:** Boolean forms and Free Boolean algebras – Values of Boolean expressions and Boolean functions.

#### TEXT BOOK:

1. J.P. Tremblay and R. Manohar, Discrete mathematical Structures with Applications to Computer Science, Tata McGraw Hill, Thirty-ninth reprint, 2011.

UNIT – I	Chapter – 1	Sections 1.1, 1.2.1 to 1.2.10 (expect 1.2.5)
UNIT – II	Chapter – 1	Sections 1.3.1 to 1.3.5
UNIT – III	Chapter – 1	Sections 1.5, 1.6, 1.6.4 & 1.6.5
UNIT – IV	Chapter – 4	Sections 4.1.1 to 4.1.5
UNIT – V	Chapter – 4	Sections 4.2 & 4.3

#### REFERENCE(S):

1. RakeshDube, AdeshPandey and Ritu Gupta, Discrete Structures and Automata Theory, Narosa Publishing House, 2000.
2. John E. Hopcroft, Jeffery D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publishing House, New Delhi, 1995.

**Web Link:**

1. <https://www.pdfdrive.com/mathematical-structures-for-computer-science-discrete-mathematics-and-its-applications-e158202395.html>
2. <https://www.pdfdrive.com/introduction-to-automata-theory-languages-and-computations-e184570093.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	23UMA5DE2	DISCRETE MATHEMATICS					4	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2		✓		✓					✓	✓	
CO3					✓		✓	✓			
CO4	✓	✓	✓			✓			✓	✓	
CO5	✓	✓	✓			✓	✓	✓	✓	✓	
Number of Matches(✓) = <b>32</b>						Relationship: <b>MODERATE</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – VI

Course Code: 23UMA6CC12  
Instruction Hours: 6  
Credits: 6

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – XIII – LINEAR ALGEBRA

#### OBJECTIVES:

- Vector Spaces, linear dependence and independence of vectors. Dual spaces, Inner product and norm – orthogonalization process.
- Linear transformations. Various operators on vector spaces

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Acquire a detailed knowledge about vector spaces and subspaces

**CLO 2:** Explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis

**CLO 3:** Understand the concept of Inner Product Space.

**CLO 4:** Illustrate inverse of matrix and matrices of algebra.

**CLO5:** Find the Eigen values and Eigen vectors, to apply the concepts for diagonalization.

#### UNIT – I

**Vector Space:** Definition and Examples – Subspaces – Linear Transformation – Fundamental Theorem of Homomorphism.

#### UNIT – II

**Span of a Set:** Linear Independence – Basis and Dimension – Rank and Nullity – Matrix and Linear transformation.

#### UNIT – III

**Inner Product Space:** Definition and Examples – Orthogonality – Orthogonal Complement.

#### UNIT – IV

**Theory of Matrices:** Algebra of Matrices - Types of Matrices – The Inverse of a Matrix – Elementary Transformations.

#### UNIT – V

**Matrices:** Rank of a matrix – Simultaneous Linear Equations – Characteristics Equations and Cayley Hamilton theorem - Eigen values and Eigen vectors.

#### TEXTBOOK:

1. S. Arumugam and A.Thangapandi Isaac, Modern Algebra, SciTechPublications (India) Ltd., Chennai, Edition 2012.

UNIT – I	Chapter – 5	Sections 5.1 to 5.3
UNIT – II	Chapter – 5	Sections 5.4 to 5.8
UNIT – III	Chapter – 6	Sections 6.1 to 6.3
UNIT – IV	Chapter – 7	Sections 7.1 to 7.4
UNIT – V	Chapter – 7	Sections 7.5 to 7.8

#### REFERENCE(S):

1. N. Herstein, Topics in Algebra, Second Edition, John Wiley & Sons (Asia),1975.
2. Kenneth M Hoffman and Ray Kunze, Linear Algebra, Seventh Edition, Pearson India Education services,Noida,India,2017

#### Web Link:

1. <https://www.pdfdrive.com/topics-in-algebra-inherstein-e34321263.html>
2. <https://www.math.pku.edu.cn/teachers/anjp/textbook.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	23UMA6CC12	LINEAR ALGEBRA					6	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓		✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓		✓	✓	✓	✓			✓	
CO3	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO4	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓			✓			✓	
Number of Matches(✓) = <b>40</b> Relationship: <b>HIGH</b>											

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – VI

Course Code: 23UMA6CC13

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### CORE COURSE – XIV – COMPLEX ANALYSIS

#### OBJECTIVES:

- Understand the concept of mappings and transformations.
- Compute complex contour integrals and applying Cauchy 's integral in various versions.
- Understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Understanding and significance of Limits, Continuous functions and Differentiability for complex function and be familiar with the CR-equation.

**CLO 2:** Explain the concept of Define Bilinear transformations, Cross ratio and Fixed points.

**CLO 3:** Explain about the Elementary transformation - Bilinear transformations.

**CLO 4:** Find the nature of singularities, to derive Taylor's and Laurent's series

**CLO 5:** Find Residues and evaluate complex integral using Cauchy's Residue Theorem

#### UNIT – I

**Functions of a complex variable:** Functions of a complex variable – Limits – Theorems on Continuous functions - Differentiability – The Cauchy Riemann equations – Analytic functions – Harmonic functions.

#### UNIT – II

**Bilinear transformation:** Elementary transformation - Bilinear transformations – Cross ratio – fixed points of bilinear transformations.

#### UNIT – III

**Complex Integration:** Definite integral – Cauchy's Theorem – Cauchy's integral formula – Higher Derivatives.

#### UNIT – IV

**Series Expansion:** Taylor's Series – Laurent's series – Zeros of an analytic functions – Singularities.

#### UNIT – V

**Calculus of Residues:**Residue -Cauchy's residues theorem – Evaluation of definite Integrals.

#### TEXT BOOK:

1. S.Arumugam, A.Thangapandi Isaac &A.Somasundaram, "Complex Analysis", New Scitech Publications (India) Pvt Ltd, 2002.

UNIT– I	Chapter – 2	Sections 2.1to 2.8
UNIT –II	Chapter– 3	Sections 3.1 to 3.4
UNIT– III	Chapter–6	Sections 6.1 to 6.4
UNIT –IV	Chapter– 7	Sections 7.1 to 7.4
UNIT –V	Chapter– 8	Sections 8.1 to 8.3

#### REFERENCE(S):

1. T.K.ManicavachagomPillay, Complex Analysis, S.Viswanathan Publishers PvtLtd, 1994.
2. Churchill.R.V & Brown, "Complex variables and applications" fourth edition, McGraw Hill international Edition.
3. Shanthi Narayan, P.K.Mittal, "Theory of Functions of Complex Variable" S.Chand & CompanyLtd, Revised 8th edition 2005.

#### Web link:

1. <https://www.pdfdrive.com/complex-analysis-e9298309.html>
2. <https://www.pdfdrive.com/brown-churchill-complex-variables-e24383446.html>
3. <https://www.pdfdrive.com/complex-analysis-an-introduction-to-the-theory-of-analytic-functions-of-one-complex-variable-e186442159.html>

4. <https://nptel.ac.in/courses/111/103/111103070/>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	23UMA6CC13	COMPLEX ANALYSIS					6	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓			✓	✓	✓	✓	✓	✓	✓	
CO3	✓			✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓	✓	✓	✓			
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = <b>42</b> Relationship: <b>HIGH</b>											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – VI

Course Code: 23UMA6CC14  
Instruction Hours: 5  
Credits: 5

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### CORE COURSE – XV – DYNAMICS

#### OBJECTIVES:

- To provide a basic knowledge of the behavior of objects in motion.
- To develop a working knowledge to handle practical problems.

#### COURSE LEARNING OUTCOME:

**CLO 1:** Explain about Gains knowledge regarding Projectiles.

**CLO 2:** Acquire knowledge on impact of a particle on a surface.

**CLO 3:** Study the concept of simple harmonic motion

**CLO 4:** Find the Differential equation of Central Orbit and Pedal equation of Central Orbit.

**CLO 5:** Understand the moment of inertia.

#### UNIT – I

**Projectiles:** Equation of Path - Range - Maximum height - Time of flight - Characteristics - Range on an inclined plane.

#### UNIT – II

**Collision of elastic bodies:** Laws of Impact - Direct and oblique impact - Impact on a fixed plane - Direct impact of two smooth Spheres-Loss of kinetic energy during direct impact.

#### UNIT – III

**Simple harmonic motion:** Simple harmonic motion (S.H.M) in a straight line - Geometrical representation - Composition of S.H. M's of same period in the same line and along two perpendicular directions.

#### UNIT – IV

**Motion under the action of Central Forces:** Velocity and acceleration in Polar co-ordinates - Differential equation of Central Orbit - Pedal equation of Central Orbit – Velocities in a Central Orbit- Inverse Square Law.

#### UNIT – V

**Moment of Inertia:** Moment of Inertia - Perpendicular axes theorem - Parallel axes theorem.

#### TEXT BOOK:

1. Dr.M.K.Venkataraman, Dynamics, Agasthiyar Publications, 14<sup>th</sup> Edition, July 2011.

UNIT – I	Chapter – 6	Sections 6.2 to 6.14
UNIT – II	Chapter –8	Sections 8.1 to 8.8
UNIT – III	Chapter – 10	Sections 10.1 to 10.7
UNIT – IV	Chapter – 11	Sections 11.1 to 11.10& 11.14
UNIT – V	Chapter – 12	Sections 12.1 to 12.4

#### REFERENCE(S):

1. P. Duraipandian, LaxmiDuraipandian and MuthamizhJayapragasam, Mechanics S.Chand&Company PVT, LTD, 2014.
2. A.V.Dharmapadham, Dynamics, S, Viswanathan Publishers Pvt.Ltd. 2006.

#### Web link:

1. [http://162.241.27.72/siteAdmin/dde-admin/uploads/3/UG\\_B.Sc. Mathematics 11334-Mechanics.pdf](http://162.241.27.72/siteAdmin/dde-admin/uploads/3/UG_B.Sc._Mathematics_11334-Mechanics.pdf)
2. <https://www.pdfdrive.com/engineering-mechanics-dynamics-solutions-manual-e158251157.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	23UMA6CC14	DYNAMICS					5	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓			✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓		✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓			
CO4	✓	✓		✓	✓	✓	✓	✓			
CO5	✓	✓		✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 39 Relationship: <b>HIGH</b>											

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – V

Course Code: 23UMA6CC15

Instruction Hours: 3

Credits: 3

Exam Hours: -

Viva Voce Marks: 20

External Marks: 80

### CORE COURSE – XI – PROJECT WITH VIVA VOCE

#### COURSE LEARNING OUTCOME:

On completion of the course, the student will be able to

**CLO 1:** Identify the requirements for the real world problems.

**CLO 2:** Conduct a survey of several available literatures in the preferred field of study.

**CLO 3:** Study and enhance software/ Theoretical skills

**CLO 4:** To report and present the findings of the study conducted in the preferred domain.

**CLO 5:** Explain the point wise and uniform convergence of sequence of function and to derive the Taylor's theorem.

- All UG final year students have to carry out their mini project in the college itself.
- The objective of the mini project is to enable the students to work as individual.
- Mini Projects must be implemented using latest technology.

## SEMESTER – VI

Course Code: 23UMA6DE3

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### DISCIPLINE SPECIFIC ELECTIVE COURSE – III NUMERICAL METHODS WITH APPLICATIONS

#### OBJECTIVES:

- To apply the numerical problem in efficiency with various methods.
- To acquire the knowledge of problem solving ability.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Compute the Solution of Algebraic and Transcendental equation using Bisection, Method of false position and Newton- Raphson Method.

**CLO 2:** Find the solution of linear system of equation by Gaussian Elimination, Gauss Jacobi, and Gauss Seidel Methods.

**CLO 3:** Solve Interpolation of Finite differences, Newton's Forward, Backward differences.

**CLO 4:** Obtain the Numerical differentiation and integration.

**CLO 5:** Derive and compute the solution of Taylor series, Picard's and Euler method and Runge–Kutta Methods.

#### UNIT – I

**Algebraic & Transcendental Equations:** Finding a root of the given equation (Derivation of the formula not needed) using Bisection Method -Iteration Method -Method of False Position - Newton RaphsonMethod.

#### UNIT – II

**Solutions to Linear Systems:**Introduction- Gaussian Elimination Method- Gauss-Jordan Elimination Method- Iterative Methods -Gauss-Jacobi Method- Gauss Siedal Method of Iteration.

#### UNIT – III

**Finite Differences:** First Difference- Forward and Backward differences – Newton's Forward & Backward difference interpolation formula –Divided differences and their properties – Lagrange's Interpolation Formula. (Proof not needed).

#### UNIT – IV

**Numerical Differentiation and Integration:**Introduction –Newton's Forward – BackwardDifferences to compute Derivatives-Numerical Integration using Trapezoidal rule - Simpson's one third - Simpson's threeeight rule.

#### UNIT – V

**Numerical Solution of ODE:** Solution by Taylor Series Method - Picard's Method – Euler Method – Improved Euler's Method-Modified Euler's Method – Runge-Kutta 2<sup>nd</sup> and 4<sup>th</sup> order Methods (Derivation of the formula not needed) - Predictor Corrector Method - Milne's Predictor Corrector Methods- Adam's Predictor Corrector Method

#### TEXT BOOK:

1. Dr.P.Kandasamy, Dr.K.Thilagavty, Dr.K.Gunavathi, Numerical Methods, S.Chand& co., 2010

UNIT – I	Chapter – 3	Sections 3.1 to 3.4
UNIT – II	Chapter – 4	Sections 4.1,4.2,4.2.1,4.7 to 4.9.
UNIT – III	Chapter – 5	Sections 5.1, 5.2.
	Chapter – 6 &8	Sections 6.2, 6.3 & 8.2, 8.3, 8.7
UNIT –IV	Chapter – 9	Sections9.1 to 9.3, 9.9, 9.13, 9.14.
UNIT – V	Chapter – 11	Sections 11.5, 11.8 to 11.13, 11.16 to 11.18.

#### REFERENCE(S):

1. S. Narayanan & Others, Numerical Analysis, S. Viswanathan Publishers, 1994.
2. A.Singaravelu, Numerical Methods, Meenachi Agency, June 2000.

- S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt.Limited, 4<sup>th</sup> Edition, 2009.

**Web Link:**

- <https://nptel.ac.in/courses/111/107/111107105/>
- <https://freevidelectures.com/course/3504/numerical-methods-of-ordinary-and-partial/1>
- <https://www.classcentral.com/course/swayam-numerical-methods-for-engineers-14213>
- <https://www.pdfdrive.com/numerical-analysis-and-optimization-an-introduction-to-mathematical-modelling-and-numerical-simulation-numerical-mathematics-and-scientific-computation-d160298524.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
VI	23UMA6DE3	NUMERICAL METHODS					6	4				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2	✓					✓			✓	✓		
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO4	✓	✓	✓									
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Number of Matches(✓) = 37						Relationship: <b>HIGH</b>						

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – VI

Course Code: 23UMA6DE4

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### DISCIPLINE SPECIFIC ELECTIVE COURSE – IV GRAPH THEORY AND APPLICATIONS

#### OBJECTIVES:

- To introduce the basic concepts of Graph theory.
- To apply the Graph Theory in other disciplines.

#### COURSE LEARNING OUTCOME:

Students will be able to

**CLO 1:** Describe the origin of graph theory.

**CLO 2:** Understand Paths and Cycles

**CLO 3:** Study about Trees.

**CLO 4:** Derive the concept of Cut Sets and Connectivity.

**CLO 5:** Demonstrate Matrix Representation of graphs.

#### UNIT - I

**Graphs:** Introduction – Graphs, Finite and Null graphs – Degree of a Vertex – Isomorphism – Complete graphs – Subgraphs, Spanning and Induced Subgraphs – Degree Sequences and Partitions.

#### UNIT - II

**Paths and Cycles:** Introduction- Walks, Paths and Cycles – Connected graphs - Disconnected graphs and Components – Bipartite graphs – Operations on graphs.

#### UNIT - III

**Trees:** Introduction - Cut Vertices, Bridges and Blocks – Block graphs and cut vertex graphs – Trees – Properties of trees – Distances, centre and centroids – Spanning trees – fundamental cycles.

#### UNIT - IV

**Cut Sets and Connectivity:** Introduction – Cutsets – Properties of cutsets – Fundamental cutsets – Connectivity – Separability.

#### UNIT - V

**Matrix Representation:** Introduction – Incidence Matrix –Adjacency Matrix –cycle Matrix – Rank of a Matrix – Cutset Matrix.

#### TEXT BOOK:

1. V.R.Kulli, College Graph Theory, Vishwa International Publications, Gulbarga, 2012.

UNIT – I Chapter – 1 Sections 1.1 to 1.7

UNIT – II Chapter – 2 Sections 2.1 to 2.5

UNIT – III Chapter – 4 Sections 4.1 to 4.6, 4.10 & 4.11

UNIT – IV Chapter – 5 Sections 5.1 to 5.6

UNIT – V Chapter – 7 Sections 7.1 to 7.6

#### REFERENCE(S):

1. Harary, “Graph Theory”, Narosa Publishing House, 1989.
2. S.Arumugam “Invitation to Graph Theory”, Scitech Publishers, 2001.

**Web link:**

1. <https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf>
2. [https://www.gacwrmd.in/learning/Maths/GRAPH%20THEORY%20\(7BMAE1A\).pdf](https://www.gacwrmd.in/learning/Maths/GRAPH%20THEORY%20(7BMAE1A).pdf)

## Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	23UMA6DE4	GRAPH THEORY AND APPLICATIONS					6	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓			✓	✓		✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO4		✓	✓	✓		✓	✓	✓	✓		
CO5		✓	✓	✓	✓	✓	✓	✓	✓		
Number of Matches (✓) = <b>40</b>						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – I

Course Code: 23UMA1SE1  
Instruction Hours: 2  
Credits: 2

Exam Hours: 3  
Internal Marks: 25  
External Marks: 75

### NON MAJOR ELECTIVE – I

#### QUANTITATIVE APTITUDE AND REASONING SKILLS

##### OBJECTIVES

- To introduce a few basic and elementary concepts of mathematics for other major students.
- Gain the knowledge of solving aptitude problems,

##### COURSE OUTCOMES

1. Solve the problems based on Simple Interest
2. Solve the problems based on Compound Interest.
3. Identify the ideas of Odd Man Out and Series.
4. Understand the concept of Blood Relations.
5. Solve the problems on Analytical Reasoning

##### UNIT – I

Simple Interest

##### UNIT – II

Compound Interest.

##### UNIT – III

Odd Man Out & Series

##### UNIT – IV

Blood Relations.

##### UNIT – V

Analytical Reasoning

##### TEXT BOOK:

1. R.S. Aggarwal, Quantitative Aptitude, S. Chand & Company Ltd. Reprint 2013.
2. R.S. Aggarwal, A modern approach to Verbal & Nonverbal Reasoning, S. Chand & Company Ltd.

##### REFERENCE(S):

1. R.S. Aggarwal, Arithmetic (Subjective and Objective) For Competitive Examinations, S. Chand and Company Ltd. 2004.
2. K.P. Singh, P. Singh, Reasoning Test, General Intelligence Test, Source Books A Unit of Viva Books Pvt. Ltd, Reprint 2016

##### Web link:

1. <https://www.pdfdrive.com/test-of-reasoning-verbal-non-verbal-general-intelligence-competitive-examinations-e183869372.html>
2. <https://www.pdfdrive.com/fast-track-objective-arithmetic-e85018060.html>
3. <https://www.pdfdrive.com/test-of-reasoning-verbal-non-verbal-general-intelligence-competitive-examinations-e183869372.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UMA1SE1	QUANTITATIVE APTITUDE AND REASONING SKILLS					2	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1		✓	✓	✓	✓		✓	✓	✓		
CO2	✓	✓	✓	✓	✓		✓	✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches (✓) = 41						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER – II

Course Code: 23UMA2SE2

Instruction Hours: 2

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### NON MAJOR ELECTIVE –II

#### FOUNDATION MATHEMATICS FOR COMPETITIVE EXAMINATIONS

##### OBJECTIVE:

- To appear competitive Examinations confidently.
- To apply the skill of problem solving ability.

##### COURSE OUTCOMES

**CLO 1:** Solve the problems based on Numbers.

**CLO 2:** Understand the HCF, LCM and decimal fractions

**CLO 3:** Solve the problems based on Square roots, cube roots.

**CLO 4:** Solve the problems based on percentage, average and ratio.

**CLO 5:** Solve the problems on partnership, chain rules.

##### UNIT – I

**Numbers:** Problems on Addition – Subtraction – Multiplication and Division (Shortcut Methods) – Various tests for Divisibility – Prime and Composite numbers – Various types of numbers.

##### UNIT – II

**HCF and LCM of Numbers Decimal fractions:** Addition – Subtraction - Multiplication and Division of Decimal fractions - H.C.F and L.C.M of Decimals.

##### UNIT – III

**Simplification:** Square Root- Square Root by means of Factors – General Method – Square Root of Decimal Fractions - Square Root of Vulgar Fractions - Cube Root.

##### UNIT – IV

**Percentage:** Shortcut Method – Problems based on Population.

##### UNIT – V

Partnership.

##### TEXT BOOK:

1. R.S. Aggarwal, Quantitative Aptitude, S. Chand & Company Ltd. 2007.

##### REFERENCE(S):

3. R.S. Aggarwal, Arithmetic (Subjective and Objective) For Competitive Examinations, S.Chand and Company Ltd. 2004.
4. R.S. Aggarwal, Objective Arithmetic, S. Chand & Company Ltd. 2004.

##### Web link

1. <https://sucessguru.com/objective-arithmetic-for-competitive-examinations-pdf/>
2. <https://www.pdfdrive.com/fast-track-objective-arithmetic-e85018060.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UMA2SE2	MATHEMATICS FOR COMPETITIVE EXAMINATIONS					2	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1		✓	✓	✓	✓		✓	✓	✓		
CO2	✓	✓	✓	✓	✓		✓	✓	✓		
CO3	✓			✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches (✓) = <b>39</b>						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER - I

Course Code: 23UMAVA1

Hours: 30

Credits: 2

### VALUE ADDED COURSE – 01 - BASIC MATHEMATICS

(Offered to students of Mathematics)

#### OBJECTIVES

- To perform basic computations in higher mathematics.
- To Develop and maintain problem-solving skills.
- To Use mathematical ideas to model real-world problems

#### COURSE OUTCOMES

1. Understand the concept of sets.
2. Describe the problems in number system.
3. Identify the logics.
4. Explain the tricks to determinants.
5. Explain the concept of Problems on matrices.

#### 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.

#### RECOMMENDED TEXTS

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.

## SEMESTER - II

Course Code: 23UMAVA2

Hours: 30

Credits: 2

### VALUE ADDED COURSE – 02 – ARITHMETICAL ABILITY

(Offered to students of Mathematics)

#### OBJECTIVES

- To provide the knowledge to analyze, interpret and solve the Mathematical problems.
- To develop the thinking capacity.
- To kindle the problem solving ability of the students in statistics

#### COURSE OUTCOMES

1. Illustrate the concept of Numbers
2. Describe the problems on Decimal fractions.
3. Identify the short cuts of simplification.
4. Explain the tricks to find average.
5. Explain the concept of Problems on numbers.

#### Unit I

Number System

#### Unit II

Decimal fraction

#### Unit III

Simplification

#### Unit IV

Average

#### Unit V

Problems on numbers

#### TEXT BOOK:

1. R.S.Aggarwal, “Quantitative Aptitude” S.Chand & Company Ltd., Ram Nagar, New Delhi (2017)

UNIT – I            Chapters – 1

UNIT – II            Chapters – 3

UNIT – III           Chapters – 4

UNIT – IV            Chapters – 6

UNIT – V            Chapters – 7

**VALUE ADDED COURSE – 03 – MS OFFICE**  
**(Offered to students of Mathematics)**

**OBJECTIVES**

- To gain the knowledge of Ms-office.
- To learn concept of Ms - Excel.
- To know about MS – PowerPoint.

**COURSE OUTCOMES**

1. Give the basic knowledge on MS word.
2. Design the creation of newspaper format with header & footer.
3. Learn how to do Mail Merge practically.
4. Provide the ability to understand Excel functions.
5. Learn the better skills to effectively use Power point for presentation.

**MS- WORD**

- i. To prepare basic letter.
- ii. Preparing Time table using table properties.
- iii. To Create Mail-merge application for sending mail into many recipients.
- iv. Design a Company advertisement using header and footer.
- v. To wrapping text in newspaper format using drop cap.

**MS-EXCEL**

- i. To apply various statistical, excel function.
- ii. To prepare student mark statement with chart.
- iii. To Calculate Employee salary.
- iv. To prepare sales report.

**MS – POWER POINT**

- i. To create advertisement using various slides presentation.
- ii. To preparing a lecturer presentation.
- iii. To apply business presentation and changing the slide layout

## SEMESTER - IV

Course Code: 23UMAVA4

Hours: 30

Credits: 2

### VALUE ADDED COURSE – 04 - SECRETS OF MENTAL MATH – I

(Offered to students of Mathematics)

#### OBJECTIVE:

- To use the four operations and pick the appropriate operation for word problems.
- To understand math concepts better and get to the answer faster.
- To divide in your head can save you the inconvenience of having to pull out a calculator every time you need to compute something.

#### COURSE OUTCOMES

1. Solve add and subtract numbers from left to right instead of from right to left.
2. Understand multiply in your head one-digit numbers by two-digit numbers and three-digit numbers.
3. Apply the concept of multiply two different two-digit numbers, a challenging yet more creative task.
4. Explain the numbers of a problem of mental division.
5. Derive the guesstimation.

#### UNIT – I

Mental Addition and Subtraction.

#### UNIT – II

Basic Multiplication.

#### UNIT – III

Intermediate Multiplication.

#### UNIT – IV

Mental Division.

#### UNIT – V

The art of Guesstimation.

#### TEXT BOOK:

1. Arthur Benjamin and Michael Shermer, “Secrets of mental math” Published in the United States by Three Rivers Press, an imprint of the Crown Publishing Group, a division of Random House, Inc., New York
  - UNIT – I Chapter – 1
  - UNIT – II Chapter – 2
  - UNIT – III Chapter – 3
  - UNIT – IV Chapter – 4
  - UNIT – V Chapter – 5

#### Web Link:

1. <https://www.youtube.com/watch?v=qW2ZTa8hCWQ>
2. <https://www.youtube.com/watch?v=wZHDKw8PwtU>
3. <https://visaldiary.files.wordpress.com/2011/07/secrets-of-mental-math.pdf>

## SEMESTER - V

Course Code: 23UMAVA5

Hours: 30

Credits: 2

### VALUE ADDED COURSE – 05 - FUNDAMENTALS OF NUMERACY SKILLS

(Offered to students of Mathematics)

#### OBJECTIVES:

- To analyse, interpret and solve mathematical Problems.
- To improve one's ability to think critically.
- To learn a variety of strategies for problem solving.

#### COURSE OUTCOMES

On completion of the course the student will be able:

1. To acquire basic knowledge on Mathematics
2. Apply the tricks of multiplication with base method.
3. Illustrate the methods of Magic Squares.
4. Understand the characteristics of date.
5. To solve the Simultaneous Linear Equations.

#### UNIT – I

Base Method of Multiplication: Introduction - When the number of digits in RHS exceeds number of zeros in the base - Multiplying a number above the base with a number below the base.

#### UNIT – II

Base Method of Multiplication: Multiplying numbers with different bases - When the base is not a power of ten Base Method for Squaring - Digit-Sum Method – Applications.

#### UNIT – III

Magic Squares – Rules - The Properties of Magic Squares.

#### UNIT – IV

Dates & Calendars - Single Year Calendar -Technique -Characteristics of Dates

#### UNIT – V

General Equations Method -Two Simultaneous Linear Equations - Calculating the value of 'x' & ' Y' - Specific Case.

#### Text Book:

1. Dhaval. Bathia , Vedic Mathematics Made Easy, Jaico Publishing House, Mumbai, 2006.

#### Reference Book:

1. Bharati Krsna Tirthaji Maharaja, Vedic Mathematics, Motilal Banarsidass Publishers Private Ltd, Delhi, Re-Print 2004
2. Ronak Bajaj, Vedic Mathematics, Black Rose Publications, 2005

#### Web Link

1. <http://webeducation.com/wp-content/uploads/2020/01/Dhaval-Bathia-Vedic-Mathematics-Made-Easy-Jaico-Publishing-House-2012.pdf>
2. [https://www.ms.uky.edu/~sohum/ma330/files/manuscripts/Tirthaji\\_S.B.K.,\\_Agarwala\\_V.S.-Vedic\\_mathematics\\_or\\_sixteen\\_simple\\_mathematical\\_formulae\\_from\\_the\\_Vedas-Orient\\_Book\\_Distributors\\_1981.pdf](https://www.ms.uky.edu/~sohum/ma330/files/manuscripts/Tirthaji_S.B.K.,_Agarwala_V.S.-Vedic_mathematics_or_sixteen_simple_mathematical_formulae_from_the_Vedas-Orient_Book_Distributors_1981.pdf)

## SEMESTER - VI

Course Code: 23UMAVA6

Hours: 30

Credits: 2

### VALUE ADDED COURSE – 06 - SECRET OF MENTAL MATH - II (Offered to students of Mathematics)

#### OBJECTIVE:

- To understand math concepts better and get to the answer faster.
- To divide in your head can save you the inconvenience of having to pull out a calculator every time you need to compute something.

#### COURSE OUTCOMES

1. Solve add and subtract numbers from left to right instead of from right to left.
2. Understand multiply in your head one-digit numbers by two-digit numbers and three-digit numbers.
3. Apply the concept of multiply two different two-digit numbers, a challenging yet more creative task.
4. Explain the numbers of a problem are too long to remember.
5. Illustrate the helps of mathematics in various field.

#### UNIT – I

Pencil-and-Paper Multiplication.

#### UNIT – II

Memorize numbers.

#### UNIT – III

Advanced Multiplication.

#### UNIT – IV

The Art of Mathematical Magic.

#### UNIT – V

How Math Helps Us Think About Weird Things.

#### TEXT BOOK:

1. Arthur Benjamin and Michael Shermer, “Secrets of mental math” Published in the United States by Three Rivers Press, an imprint of the Crown Publishing Group, a division of Random House, Inc., New York

UNIT – I	Chapter – 6
UNIT – II	Chapter – 7
UNIT – III	Chapter – 8
UNIT – IV	Chapter – 9
UNIT – V	Chapter – 10

#### Web Link:

1. <https://www.youtube.com/watch?v=qW2ZTa8hCWQ>
2. <https://www.youtube.com/watch?v=wZHDKw8PwtU>
3. <https://visaldiary.files.wordpress.com/2011/07/secrets-of-mental-math.pdf>