

B.Sc MATHEMATICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2022-2023 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)



THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B⁺⁺)

(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 Acquire knowledge, understand concepts and apply new ideas which enable them to be employable or self-employed.

1. Demonstrate motivation in advancing to higher learning programmes.
2. Engage in socially responsible behaviour and have value added education.
3. Have exposure to technical proficiency, analytical capability, soft skills and life skills development.
4. 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 - Course Structure under CBCS
(For the candidates admitted from the academic year 2022 - 2023 onwards)

Semester	Part	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
1	I	22UT1/H1	Language - I	6	3	3	25	75	100
1	II	22UE1	English - I (Communicative English-I)	6	3	3	25	75	100
1	III	22UMA1CC1	Differential Calculus	5	4	3	25	75	100
1	III	22UMA1CC2	Integral Calculus	4	4	3	25	75	100
1	III	2UPH1AC1	Physics – I (Properties of Matter, Thermal Physics and Optics)	4	3	3	25	75	100
1	III	22UPH2AP1	Physics – II (Practical)	3	-	-	-	-	-
1	IV	22UVE	Value Education	2	2	3	25	75	100
Total				30	19	-	-	-	600
2	I	22UT2/H2	Language - I	6	3	3	25	75	100
2	II	22UE2	English – II (Communicative English -II)	6	3	3	25	75	100
2	III	22UMA2CC3	Differential Equations	5	4	3	25	75	100
2	III	22UMA2CC4	Analytical Geometry (3D) and Trigonometry	5	4	3	25	75	100
2	III	22UPH2AP1	Physics – II (Practical)	2	3	3	40	60	100
2	III	22UPH2AC2	Physics – III (Electricity, Electronics, Atomic and Nuclear Physics)	4	3	3	25	75	100
2	IV	22UES	Environmental Studies	2	2	3	25	75	100
Total				30	22	-	-	-	700
3	I	22UT3/H3	Language - I	6	3	3	25	75	100
3	II	22UE3	English-III (Language Through English Literature and Communicative Skills - I)	6	3	3	25	75	100
3	III	22UMA3CC5	Classical Algebra and Theory of Numbers	5	5	3	25	75	100
3	III	22UMA3CC6	Laplace Transforms and Fourier Series	5	4	3	25	75	100
3	III	22UMA3AC3	Mathematical Statistics – I	4	4	3	25	75	100
3	IV	22UMA4AP2	Mathematical Statistics – II (Practical)	2	-	-	-	-	-
3	IV		Non Major Elective - I	2	2	3	25	75	100
Total				30	21	-	-	-	600
4	I	22UT4/H4	Language - I	6	3	3	25	75	100
4	II	22UE4	English – IV (Language Through English Literature and Communicative Skills - II)	6	3	3	25	75	100
4	III	22UMA4CC7	Vector Calculus	4	4	3	25	75	100
4	III	22UMA4CC8	Abstract Algebra	4	4	3	25	75	100

4	III	22UMA4AC4	Mathematical Statistics - III	4	4	3	25	75	100
4	III	22UMA4AP2	Mathematical Statistics – II (Practical)	2	3	3	40	60	100
4	IV		Non Major Elective - II	2	2	3	25	75	100
4	IV	22UMA4SBE1:1 22UMA4SBE1:2	Mathematics for Competitive Examinations - I Page Maker	2	2	3	25	75	100
Total				30	25	-	-	-	800
5	III	22UMA5CC9	Linear Algebra	5	5	3	25	75	100
5	III	22UMA5CC10	Real Analysis	5	5	3	25	75	100
5	III	22UMA5CC11	Statics	5	4	3	25	75	100
5	III	22UMA5CC12	Programming in C	5	4	3	25	75	100
5	III	22UMA5MBE1:1 22UMA5MBE1:2 22UMA5MBE1:3	Numerical Methods Discrete Mathematics MS – Office	4	3	3	25	75	100
5	IV	22UMA5SBE2:1 22UMA5SBE2:2	Mathematics for Competitive Examinations - II Latex Theory	2	2	3	25	75	100
5	IV	22UMA5SBE3:1 22UMA5SBE3:2	Numerical Methods with MATLAB – Practical Latex - Practical	2	2	3	40	60	100
5	IV	22USSD	Soft Skill Development	2	2	3	25	75	100
Total				30	27	-	-	-	800
6	III	22UMA6CC13	Complex Analysis	6	6	3	25	75	100
6	III	22UMA6CC14	Dynamics	6	5	3	25	75	100
6	III	22UMA6CC15	Graph Theory	6	5	3	25	75	100
6	III	22UMA6MBE2:1 22UMA6MBE2:2 22UMA6MBE2:3	Operations Research Astronomy Coding Theory	6	4	3	25	75	100
6	III	22UMA6MBE3:1 22UMA6MBE3:2 22UMA6MBE3:3	Mini Project Elementary Number Theory Mathematical Modelling	5	4	3	- 25 25	- 75 75	100
6	V	22UGS	Gender Studies	1	1	3	25	75	100
6	V		Extension Activities	-	1	-	-	-	-
Total				30	26	-	-	-	600
Grand Total				180	140				4100

List of Allied Courses**Group I (Any one)**

1. Physics
2. Computer Science
3. Financial Accounting

Group II (Any one)

1. Mathematical Statistics
2. Chemistry
3. Management Accounting

Paper Details:

Tamil Paper - Part I	- 4
English Paper - Part II	- 4
Core Course Paper	- 15
Allied Course Paper	- 4
Allied Course Practical	- 2
Non-Major Elective	- 2
Skill Based Elective	- 3
Major Based Elective	- 3
Environmental Studies	- 1
Value Education	- 1
Soft Skill Development	- 1
Gender Studies	- 1
Extension Activities	- 1 (Credit Only)

Note:

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

- Mini Project : 100 Marks
- Dissertation : 80 Marks
- Viva Voce : 20 Marks

NME Course offered to Other Department

22UMA3NME1 – Foundation of Mathematics for Competitive Examinations.

22UMA4NME2 – Quantitative Aptitude and Reasoning skills.

Allied Mathematics Courses offered

S.No	Department	Course	Code
1	Computer Application	Numerical Methods and Statistics	22UMA1AC1
		Operations Research	22UMA2AC2
2	Computer Science & Information Technology	Numerical Methods	22UMA1AC1:1
		Statistical Methods	22UMA2AC2:1
		Operations Research	22UMA2AC3:1
3	Physics	Algebra and Calculus	22UMA1AC1:2
		Analytical Geometry (3D), Trigonometry and Fourier Series	22UMA2AC2:2
		Differential Equations and Laplace Transforms	22UMA2AC3:2
4	Management Studies	Mathematics & Statistics for Managers	22UMA2AC1
		Operations Research	22UMA4AC2

Question Paper Pattern

Mathematics Programme		
Maximum Marks : 75		Duration: 3 Hours
Part – A	20 Multiple Choice Questions	20 x 1 = 20 Marks
Part – B Paragraph	5 Questions (Internal Choice) One set of questions from each unit	5 x 5 = 25 Marks
Part – C Essay Type	3 Questions (Answer any 3 out of 5 Questions) One question from each unit	3 x10 = 30 Marks
Total		75 Marks

MODEL QUESTION PAPER:

B.Sc., SEMESTER EXAMINATION

Time: 3 Hours

Maximum Marks - 75

SECTION – A

Answer **ALL** of the Following

(20 X 1 = 20 Marks)

SECTION – B

Answer **ALL** of the Following

(5 X 5 = 25 Marks)

SECTION – C

Answer any **THREE** of the Following

(3 X 10 = 30 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]

SEMESTER – I

Course Code: 22UMA1CC1

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 4

External Marks: 75

CORE COURSE – I – DIFFERENTIAL CALCULUS**OBJECTIVES:**

- To understand the knowledge about differentiation.
- To analyse the concept of asymptotes, singular point & envelopes.

COURSE OUTCOMES:

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

1. Gain the knowledge of successive differentiation.
2. Find curvature, circle, radius and centre of curvature.
3. Find the Asymptotes and intersection of a curve with its asymptotes.
4. Examine the nature of the specified point on a curve.
5. Find the envelope of one and two parameter family of curves.

UNIT – I

Successive Differentiation: Methods of Successive Differentiation – Leibnitz’s Theorem and its Applications – Increasing & Decreasing functions – Maxima and Minima of function of two variables.

UNIT – II

Curvature : Curvature – Radius of curvature in Cartesian and Polar Coordinates – Centre of Curvature – Evolutes and Involutives – Pedal Equation.

UNIT – III

Asymptotes: Asymptotes - Asymptotes parallel to the axis – special cases – Another method for finding asymptotes – Asymptotes by inspection – intersections of a curve with its asymptotes.

UNIT – IV

Singular Points: Multiple points- species of double points – To examine the nature of a specified point on a curve– Investigation of the double point – Practical rule to determine double points – To determine the species of the cusp.

UNIT – V

Envelope: Envelope of the one parameter family of curves – Envelope of two parameter Family - Envelope of normal to a curve.

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 2.2
	Chapter – 4 &	Sections 2.1, 2.2 &
	Chapter – 5	Sections 1.1 to 1.4 of [1]
UNIT – II	Chapter – 10	Sections 2.1 to 2.8 of [1]
UNIT – III	Chapter – 11	Sections 1 to 7 of [1]
UNIT – IV	Chapter – 12	Sections 1 to 7 of [1]
UNIT – V	Chapter – 8	Sections 8.1 to 8.19 of [2]

REFERENCE(S):

1. S.Arumugam,A.Thangapandi Isaac “Calculus”,Volume-I, New GammaPublications,1991.
2. Singaravelu, “Differential Calculus and Trigonometry”, AR Publications,2003.

Web Link:

1. <https://www.pdfdrive.com/calculus-vol-1pdf-e7039049.html>
2. <http://mathworld.wolfram.com>.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22UMA1CC1	DIFFERENTIAL CALCULUS					5	4			
Course Outcomes (COs)	ProgrammeOutcomes(Pos)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓				✓	
CO2			✓	✓	✓	✓	✓	✓	✓	✓	
CO3			✓				✓				
CO4	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	1	1	1	24	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22UMA1CC2

Exam Hours: 3

Instruction Hours: 4

Internal Marks: 25

Credits: 4

External Marks: 75

CORE COURSE – II–INTEGRAL CALCULUS**OBJECTIVES:**

- To understand the knowledge about Integration.
- To Analyse the concept of Double and Triple Integral.

COURSE OUTCOMES:

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

1. Revision of all the basic concept of integral models.
2. To learn the properties of definite integrals.
3. Solving technique of integrals, Integration by parts and Bernoulli's formula
4. To learn evaluation of double and triple integration and its application to area and volume.
5. Discuss Beta & Gamma functions.

UNIT – I

Integration: Introduction – Methods of integrations – Integration of Rational Algebraic function – Simple problems

UNIT – II

Integration Models (continued): Properties of Definite integrals - Integration by Parts

UNIT – III

Reduction Formula -Bernoulli's formula

UNIT – IV

Double and Triple Integrals: Changing the order of integration - Applications of Double and Triple Integrals in finding area and volume.

UNIT – V

Beta and Gamma functions: Improper integral – Applications of Beta and Gamma functions in evaluation of double and triple integrals.

TEXT BOOK(S):

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

UNIT – I	Chapter – 1	Sections 1 to 8 of [1]
UNIT – II	Chapter – 1	Sections 9 to 12 of [1]
UNIT – III	Chapter – 1	Sections 13, 14, 15.1 of [1]
UNIT – IV	Chapter – 5	Sections 1 to 7 of [1]
UNIT – V	Chapter – 7	Sections 1.1 to 6 of [1]

REFERENCE(S):

1. S.Arumugam ,A.Thangapandi Isaac "Calculus", Volume-I, New Gamma Publications, 1991.
2. A. Singaravelu, "Differential Calculus and Trigonometry", AR Publications, 2003.

Web Link:

1. <https://www.pdfdrive.com/calculus-vol-1pdf-e7039049.html>
2. <https://www.pdfdrive.com/differential-and-integral-calculus-e51807926.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22UMA1CC2	INTEGRAL CALCULUS					4	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(✓) = 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
12	3	3	3	12	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22UMA2CC3

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – III – DIFFERENTIAL EQUATIONS**OBJECTIVES:**

- To study the methods used to solve differential equations of first order and second order.
- To promote the knowledge in the field of partial differential equations of first order

COURSE OUTCOMES:

1. Define Linear equation and Bernoulli's equation.
2. Equations solvable for dy/dx , x and y .
3. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.
4. Discuss and demonstrate the Linear equations with variable coefficients and Variation of parameters.
5. Describe the origin of partial differential equation and distinguish the integrals of first order linear Partial differential equation into complete, general and singular integrals.

UNIT – I

Linear equations – Bernoulli's equation – Exact differential equations.

UNIT – II**Ordinary Differential Equations:** First order higher degree equations -solvable for x , y , p - Clairaut's form**UNIT – III**Second Order Linear differential equations with constant coefficients -finding the PI for functions of the form xe^{mx} -higher order equations where $f(D)$ is factorizable.**UNIT – IV**

Linear equations with variable co-efficient – Method of variation of parameters.

UNIT – V**Partial Differential Equations:** Formation of equations by elimination of arbitrary constants and functions -Definition of general, particular and complete solutions - solving standard forms

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

(iii) $f(x,p)=f(y,q)$ (iv) $z = px + qy + f(p,q).$

- Lagrange's Differential equations $Pp+Qq = R$ - Equations reducible to standard forms - Charpit's Method.**TEXT BOOK:**

1. S. Narayanan and T. K. Manicavachagam Pillai, Differential Equations and its Applications, S. Viswanathan Publishers Pvt. Ltd., 2011.

UNIT – I	Chapter – 2	Sections 4, 5, 6.1 to 6.4
UNIT – II	Chapter – 4	Sections 1 to 3
UNIT – III	Chapter – 5	Sections 1 to 4
UNIT – IV	Chapters – 5 & 8	Sections 5 & 4
UNIT – V	Chapter – 12	Sections 1 to 6

REFERENCE(S):

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co. 2010.
2. M.L. Khanna, Differential Equations, Jai PrakashNath and Co. 2004.

Web Link

1. <http://mathworld.wolfram.com>.
2. <https://pdflife.one/download/4539574-downloads-ordinary-and-partial-differential-equations-by-m-d-raisinghania-s-chand-pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
II	22UMA2CC3	DIFFERENTIAL EQUATIONS					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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
17	0	0	0	17	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22UMA2CC4

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 4

External Marks: 75

CORE COURSE – IV –ANALYTICAL GEOMETRY (3D) AND TRIGONOMETRY**OBJECTIVES:**

- To promote knowledge in the field of Analytical geometry.
- To acquire the knowledge of problem solving ability.

COURSE OUTCOMES:

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

1. Evaluate Length of the perpendicular and bisecting the angle between two planes.
2. Finding centre, radius and length of the tangent plane to a sphere.
3. To recognize the conic sections and cylinder in their general forms.
4. Expansion of $\sin nx, \cos nx, \tan nx$ and powers of sines and cosines in terms of functions of multiples of θ
5. Define and illustrate the concept of hyperbolic functions

UNIT – I

Plane:Equation of a plane - Angle between two planes – Angle bisector of two planes.

UNIT – II

Sphere:Equation of a sphere– Tangent line -Tangent plane – Section of a sphere.

UNIT – III

Cone and Cylinder:Equation of a cone – Cone with vertex at the origin – Quadric cone with the vertex at the origin – Right circular cone – Cylinder – Right circular cylinder.

UNIT – IV

Expansions: Expansions of $\cos nx, \sin nx, \tan nx$ -Expansion of $\cos^n x, \sin^n x$ -Expansion of $\sin \theta, \cos \theta$ and $\tan \theta$ in ascending powers of θ .

UNIT – V

Hyperbolic Functions:Definition-Relation between Hyperbolic Functions – Inverse Hyperbolic Functions.

TEXT BOOK:

1. Arumugam and Issac, Analytical Geometry of three dimensions and vector calculus, New Publishing House, 2017
2. S. Narayanan, T.K. Manichavasagam Pillai, “Trigonometry”, S. Viswanathan (Printers & Publishers, Pvt Limited, 2010.

UNIT – I	Chapter – 3	Section 3.1 to 3.3 of [1]
UNIT – II	Chapter – 5	Section 5.1 to 5.3 of [1]
UNIT – III	Chapter – 6	Section 6.1 to 6.2 of [1]
UNIT – IV	Chapter – 3	Section 1 to 5 of [2]

REFERENCE(S):

1. Shanti Narayanan, Analytical Solid Geometry, S. Chand & Company Ltd, New Delhi 2007.
2. M.L. Khanna, Solid Geometry, Jai Prakash Nath & Co, Educational Publishers, 25th Edition, 2005.

Web Link:

1. <https://www.pdfdrive.com/plane-and-solid-geometry-e48670220.html>
2. <https://www.pdfdrive.com/analytic-geometry-and-calculus-with-vectors-e18904408.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22UMA2CC4	ANALYTICAL GEOMETRY(3D) AND TRIGONOMETRY					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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
19	0	0	0	19	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22UMA3CC5

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE – V – CLASSICAL ALGEBRA AND THEORY OF NUMBERS**OBJECTIVES:**

- To acquire the basic knowledge about Inequalities.
- To solve the equations in different methods.

COURSE OUTCOMES:

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

1. Understanding the concept of Inequalities.
2. Find relation between the roots and coefficients of equations and Symmetric function of the roots.
3. Describe transformation of equation and Reciprocal equation.
4. Use Cardon's method of equation and Horner's method to Nature of roots.
5. Understanding the concept of Euler Function and integral Part of Real numbers.

UNIT – I

Inequalities –Triangle Inequalities– Arithmetic means – Geometric means -Harmonic means – CauchySchwartz Inequality.

UNIT – II

Theory of Equations: Formation of Equations – Relations between roots and coefficients – Sum of the powers of the roots– Newton's theorem

UNIT – III

Transformation of equations - Reciprocal Equations –Diminishing and increasing roots of a given equation.

UNIT – IV

Multiple Roots- Nature and position of roots – Cubic Equations solution by Cardon's method – Solution by Ferrari's method–Solution by Horner's method.

UNIT – V

Theory of numbers: Prime number - composite number–infinite sequence of primes – Decomposition of a composite number – Divisor of N– Euler's function $\phi(N)$ – Integral part of a real number – Highestpower of a prime p contained in n!.

TEXT BOOK(S):

1. S. Arumugam and A. Thangapandi Isaac, Sequences and series, New Gamma Publishing House, 2001.
2. T.K. ManickavasagamPillai, S. Natarajan and Ganapathy, "Algebra" Volume – I 2006.
3. T.K. ManickavasagamPillai, S. Natarajan and Ganapathy, "Algebra" Volume –II 2013.

UNIT – I Chapter – 2 Sections 2.1 to 2.4 of [1]

UNIT – II Chapter – 6 Sections 9 to 11, 13 to 14 of [2]

UNIT – III Chapter – 6 Sections 15 to 17 of [2]

UNIT – IV Chapter – 6 Sections 25 to 27, 34.1, 35, 30 of [2]

REFERENCE(S):

1. Arumugam. S, Thangapandi Issac, - Classical Algebra, New Gamma Publishing House, Palayamkottai.

Web link

1. <https://www.pdfdrive.com/algebra-2-linear-algebra-galois-theory-representation-theory-group-extensions-and-schur-multiplier-e181577222.html>
2. <http://www.gacariyalur.ac.in/econtent/maths/ug/UG-II-Classical-Algebra.pdf>
3. http://162.241.27.72/siteAdmin/dde-admin/uploads/1/UG_B.Sc._Mathematics_113%2013-%20Classical%20Algebra.pdf

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
III	22UMA3CC5	CLASSICAL ALGEBRA AND THEORY OF NUMBERS					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(✓) = 38 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER–III

Course Code: 22UMA3CC6

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – VI –LAPLACE TRANSFORMS AND FOURIER SERIES

OBJECTIVE:

- To get the knowledge about Laplace Transforms and Fourier series.
- To acquire the knowledge of problem solving ability.

COURSE OUTCOMES:

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

1. Understand Laplace transforms and discuss the Properties of Laplace transforms
2. Define and illustrate the inverse Laplace transforms.
3. Discuss the Application of Laplace transforms.
4. Finding Fourier expansion of aperiodic function with period 2π .
5. Deep study for development in cosine and Sine Series

UNIT – I

Laplace Transforms: 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 Systems of Differential Equations - Solution of differential Equations with variable coefficients.

UNIT – IV

Fourier series: Definition of Fourier series - Finding Fourier expansion of a periodic function with period 2π - Even and Odd functions and their properties.

UNIT – V

Fourier series (Continued): Half range Fourier series – Development in cosine and Sine Series.

TEXT BOOK(S):

1. S. Narayanan and T.K. ManicavachagomPillay, Differential Equations and its Applications, S. Viswanathan (Printers and Publishers) Pvt., Ltd. 2011.
2. S.Narayanan and T.K ManicavachagomPillay, Calculus Volume - III, S.Viswanathan Publishers Pvt., Ltd. 2011.

UNIT – I	Chapter – 9	Sections 1 to 5 of [1]
UNIT – II	Chapter – 9	Sections 6 &7 of [1]
UNIT – III	Chapter – 9	Sections 8 to 10 [1]
UNIT – IV	Chapter – 6	Sections 1 to 3 [2]
UNIT – V	Chapter – 6	Sections 4 to 5 [2]

REFERENCE(S):

1. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Laplace Transforms, McGraw Hill, 1965.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, INC, 9th Edition, 2006.

Web Link:

1. https://sv.20file.org/up1/685_0.pdf
2. http://www.bau.edu.jo/UserPortal/UserProfile/PostsAttach/59003_3812_1.pdf

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
III	22UMA3CC6	LAPLACE TRANSFORMS AND FOURIER SERIES					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 (✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
17	2	2	2	17	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – III

Course Code: 22UMA3AC3

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ALLIED COURSE – III – MATHEMATICAL STATISTICS – I**OBJECTIVES:**

- To develop the basic concepts of statistics.
- To apply the basic ideas of statistical data.

COURSE OUTCOMES:

1. Calculate Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean.
2. Illustrate the dispersion, Skewness and Kurtosis.
3. Discuss axiomatic approach towards probability and Prove addition and multiplication theorems and Solve Conditional probability for Baye's theorem.
4. Define and illustrate the random variable and distribution function and Discuss and illustrate the properties of Probability mass function, Probability density function.
5. Discuss and illustrate the Mathematical Expectation for addition and Multiplication theorem.

UNIT – I

Statistical data: Introduction–Formation of frequency distribution–Graphic representation of a frequency distribution-various measure of Central Tendency – Mean-Median- Mode- Geometric means- Harmonic mean (simple problems only).

UNIT – II

Measures of dispersion: Range- quartile deviation - mean deviation-standard deviation – Coefficient of dispersion– Skewness and kurtosis (simple problems only).

UNIT – III

Probability: Definitions of various terms–Mathematical Probability –Axiomatic Probability - Random Event –Addition and Multiplication Laws of Probability –Conditional Probability - Independent events–Baye's theorem –Simple applications.

UNIT – IV

Random Variables: Distribution functions - Discrete random variable - Continuous random variable - Joint Probability mass function - Joint Probability distribution function - Marginal distribution function- Joint density function- Conditional distribution function.

UNIT – V

Mathematical Expectation: Addition and Multiplication theorem–Covariance Expectation - variance of linear combination of random variables - Moment generating function – Characteristic function - Probability generating function–simple problems

TEXT BOOK:

1. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics – Sultan Chand & Sons, 2011.

UNIT – I	Chapter – 2	Sections 2.1 to 2.9
UNIT – II	Chapter – 2	Sections 2.13, 2.14, 2.16, 2.17
UNIT – III	Chapter – 3 & 4	Sections 3.3, 3.4, 3.8.5 to 3.12 & 4.2
UNIT – IV	Chapter – 5	Sections 5.1 to 5.5.5

REFERENCE(S):

1. Kandasamy, P.,K.Thilagavathi and K. Gunavathi, Probability, Statistics and Queueing theory – (2007) S.Chand and Co., New Delhi.
2. Vittal.P.R. Mathematical Statistics – 2004 – Maragatham Publishers.

Web Link:

1. <https://www.pdfdrive.com/mathematicsprobability-and-statisticsapplied-mathematics-e16657497.html>
2. <https://www.pdfdrive.com/mathematical-statistics-e18751543.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
III	22UMA3AC3	MATHEMATICAL STATISTICS – I					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(✓) = 38 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
39	4	4	4	39	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22UMA3NME1

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

NON MAJOR ELECTIVE –I

FOUNDATION OF MATHEMATICS FOR COMPETITIVE EXAMINATIONS

OBJECTIVE:

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

COURSE OUTCOMES

1. Solve the problems based on Numbers .
2. Understand the HCF, LCM and decimal fractions.
3. Solve the problems based on Square roots, cube roots.
4. Solve the problems based on percentage, average and ratio.
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 – Rule for converting Pure and Mixed Recurring Decimals into a Vulgar Fractions.

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 – Average - Ratio and Proportion.

UNIT - V

Partnership - Chain rule - Direct proportion – Indirect Proportion.

TEXT BOOK:

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

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://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				
III	22UMA3NME1	FOUNDATION OF 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 (✓) = 39 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	4	3	15	14	National

Green - Local, Pink - Regional, Blue - National, Brown - Global

SEMESTER – IV

Course Code: 22UMA4CC7

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – VII – VECTOR CALCULUS**OBJECTIVES:**

- To provide the basic knowledge of vector differentiation & vector integration.
- To understand line integral, surface integral and volume integral and understand their inter-relations and their applications.

COURSE OUTCOMES:

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

1. Acquire the basic knowledge of vector differentiation.
2. Compute the curl and the Divergence of vector fields.
3. Define and illustrate the vector integration and Line integral.
4. Compute Surface and Volume integrals
5. Evaluate Gauss divergence theorem, Stoke's theorem and Green's theorem.

UNIT – I

Vector Differentiation: Limit of a vector function – Continuity of vector functions – Derivative of a vector function – Geometrical significance of vector differentiation – Physical application of derivatives of vectors – Partial derivatives of a vector function – Scalar and vector point functions – Level surface – Gradient of a scalar point function – Directional derivative of a scalar point function – Equation of tangent plane and normal line to level surface.

UNIT – II

Divergence and curl of a vector point function – Solenoidal vector – Irrotational vector – Vector identities.

UNIT – III

Vector Integration: Vector integration – Line integral – Application of line integral

UNIT – IV

Vector Integration (Continued): Surface and Volume integrals – Applications - Gauss Divergence theorem

UNIT – V

Vector Integration (Continued): Stoke's theorem – Green's theorem in plane

TEXT BOOK(S):

1. P. R. Vittal and V. Malini, Vector Analysis, Margham Publications, Chennai, 2006.

UNIT – I	Chapter – 1	Pages 1 to 20
UNIT – II	Chapter – 1	Pages 22 to 51
UNIT – III	Chapter – 2	Pages 54 to 72
UNIT – IV	Chapter – 2	Pages 75 to 106
UNIT – V	Chapter – 2	Pages 108 to 140

REFERENCE(S):

1. P. R. Vittal, Allied Mathematics, Margham Publications, Reprint 2010.
2. P. Duraipandiyan and Lakshmi Duraipandian, Vector Analysis, Emerald publishers, 1986.

Web Link:

1. http://oms.bdu.ac.in/ec/admin/contents/175_16SCCMM7_2020051906032646.pdf
2. <https://wepdf.com/download-allied-mathematics-p-r-vittal-notes-pdf-d112197901>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
IV	22UMA4CC7	VECTOR CALCULUS					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(✓) = 38 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
23	2	2	2	23	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22UMA4CC8

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – VIII – 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

1. Recognize the mathematical objects called groups.
2. Find cycles, Order of an element and Cosets.
3. Explain the significance of the notions of normal subgroups, and Cayley's Theorem.
4. Gains knowledge in Ring theory.
5. Learn the construction of field of quotients of an integral domain.

UNIT – I

Groups: Definition and **Examples** – Simple Properties of Groups - Permutation groups.

Subgroup: Necessary and sufficient condition for a subset to be a subgroup – Order of the Group – Centre of a group – Normalizer and Centralizer - Product of two subgroups – Order of HK – Necessary and sufficient condition for HK to be of a cyclic group a subgroup – Intersection and union of subgroups.

UNIT – II

Cyclic Group: Cyclic subgroups-generators of a cyclic group – Number of generators of a cyclic groups –Order of an element -Cosets – left cosets and right cosets – Partitioning of a group by cosets – Lagrange's theorem – Euler's theorem – Fermat's theorem.

UNIT – III

Normal subgroups: Quotient groups – Group Homomorphism – Canonical Homomorphism – Kernel of a homomorphism – Isomorphism – Automorphism -Inner Automorphism – Cayley's Theorem.

UNIT – IV

Rings: Definition and **Examples** – Elementary properties of a ring –Isomorphism–Types of rings– Characteristic of a ring– Sub rings- Ideals – Left ideal – Right ideal – Principal ideal – Integral Domain – Quotient ring

UNIT – V

Rings (Continued): Maximal and prime Ideals–Homomorphisms of Rings – Field of quotients of Integral domain – Ordered Integral domain – UFD – Euclidean 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, 3.2, 3.4 & 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 4.8

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				
IV	22UMA5CC8	ABSTRACT ALGEBRA					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 (✓) = 38						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
47	2	2	2	47	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – IV

Course Code: 22UMA4AC4

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ALLIED COURSE – IV –MATHEMATICAL STATISTICS – III**OBJECTIVES:**

- To assist the students to gain the proficiency in Mathematical statistics.
- To deduce statistical inference of a data through sampling techniques.

COURSE OUTCOMES:

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

1. Understand the concept of Correlation.
2. To Gain the Knowledge of Regression.
3. To be able to deduce statistical inference of a data through sampling techniques Understand Student's t-test of Difference of means.
4. Student learns how to Test of significance for large samples.
5. Understand Chi-Square variate and independence of attributes.

UNIT –I

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

UNIT – II

Regression: Introduction– Linear regression – curvilinear regression –regression curves.

UNIT –III

Test of significance for Small samples:Parameter and statistics – Statistical hypothesis- Students t test and its properties– independent and paired t tests – **Simple Problems**–Snedcer's Ftest and its properties –**Simple Problems**

UNIT – IV

Test of significance for large samples:One tailed and two tailed tests – Significance difference between one and two proportion based tests - Significance difference between one and two meanbased tests –**Simple Problems**

UNIT –V

Chi-Square distribution: Properties – **Uses** – Goodness of fit –Conditions for the validity – Independence of attributes.

TEXT BOOK(S):

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2011, Sultan Chand & Sons publications, New Delhi.
2. T. Veerarajan, Probability, Statistics and Random processes, 3rd Edition: 2012, Tata McGraw Hill Education Private Limited, New Delhi.

UNIT – I	Chapter – 10	Sections 10.1 to 10.4, 10.7 of [1]
UNIT – II	Chapter – 11	Sections 11.1 to 11.4 of [1]
UNIT – III	Chapter – 8	Page no. 419 to 421, 447 to 464[2]
UNIT – IV	Chapter – 8	Page no. 422 to 442[2]
UNIT – V	Chapter – 8	Page no. 466 to 482 [2]

REFERENCES:

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
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			
IV	22UMA4AC4	MATHEMATICAL STATISTICS - III					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: 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	4	4	4	25	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – IV

Course Code: 22UMA4AP2

Instruction Hours: 4

Credits: 3

Exam Hours: 3

Internal Mark: 40

External Marks: 60

ALLIED PRACTICAL– II
MATHEMATICAL STATISTICS –II(PRACTICAL)**OBJECTIVES:**

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

COURSE OUTCOMES:

1. Problem solving skills of students are enhanced.
2. Theoretical concepts are strengthened by solving maximum no. of problems
3. Due to one to one interaction with the teacher doubts of the students get cleared if any.
4. Students learn how to apply mathematical concepts to practical and real life problems.
5. Interdisciplinary approach is developed.

UNIT –I

Formation of frequency distribution-Measures of central tendency: Mean – Median – Mode-Geometric mean-Harmonic mean-Measures of dispersion: Range-Quartile deviation- Mean Deviation- Standard deviation – coefficient of variation

UNIT – II

Measures of Skewness and kurtosis – Calculation of first four Moments-Central Moments β_1, β_2 - Marginal Distribution and Conditional Distribution-Calculation of Mean – Variance-Covariance of Expectation.

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' 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:

- <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	22UMA4AP2	MATHEMATICAL STATISTICS – II (PRACTICAL)					4	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(✓) = 35 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
30	3	25	2	24	Regional

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22UMA4NME2

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

NON MAJOR ELECTIVE – II

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

OddMan Out & Series

UNIT – IV

BloodRelations.

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 & Non verbal 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			
IV	22UMA4NME2	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: 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
5	3	4	6	5	National

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22UMA4SBE1:1

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

SKILL BASED ELECTIVE – I**MATHEMATICS FOR COMPETITIVE EXAMINATION – I****OBJECTIVES:**

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

COURSE OUTCOMES:

1. Solve the problems based on Numbers
2. Understand the decimal fractions and simplification.
3. Solve the problems based on Percentage, Profit and Loss,.
4. Solve the problems based on Ratio and Proportion
5. Solve the problems on Age.

UNIT – I

Numbers – HCF – LCM – Problems on numbers

UNIT – II

Decimal Fractions- Simplification.

UNIT – III

Percentage– Profit and Loss

UNIT – IV

Ratio and Proportion– Partnership – Allegation or Mixture

UNIT – V

Average – Problems on Age

TEXT BOOK:

1. Scope and treatment as in “Quantitative Aptitude” by R.S.Aggarwal, S.Chand & Company Ltd., Ram Nagar, New Delhi (2007)

UNIT – I Chapters – 1, 2 & 7

UNIT – II Chapters – 3 & 4

UNIT – III Chapters – 10 & 11

UNIT – IV Chapters – 12, 13 & 20

UNIT – V Chapters – 6 & 8

Web Link:

1. <https://www.pdfdrive.com/complete-quantitative-aptitude-questions-complete-quantitative-aptitude-questions-for-sbiibps-e55204726.html>
2. <https://www.pdfdrive.com/quantitative-aptitude-and-reasoning-e187540802.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
IV	22UMA4SBE1:1	MATHEMATICS FOR COMPETITIVE EXAMINATION-I					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(✓) = 38 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
13	1	3	7	6	National

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – IV

Course Code: 22UMA4SBE1:2

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

SKILL BASED ELECTIVE – I**PAGE MAKER****OBJECTIVE:**

- The students will be able to understand the fundamentals of PageMaker
- To creating cards, book works, building booklets, completing the book.

UNIT – I

Getting Started with Adobe Page Maker 7.0- Creating a Publication - Working with Text

UNIT – II

Modifying Text- Working with Multiple Pages

UNIT – III

Working with Graphics- Formatting Text

UNIT – IV

Using Advanced Graphics- Adding Colour and Using Mail Merge

UNIT – V

Working with Long Publications - Publishing Electronically

TEXT BOOK:

Adobe PageMaker 7.0, Kevin Proot, Cengage Learning

Web Link:

1. https://www.youtube.com/watch?v=rSitQiZWB_Q
2. <https://www.youtube.com/watch?v=j4y6S20yx7o>

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
11	1	1	2	8	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – V

Course Code: 22UMA5CC9

Instruction Hours: 5

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – IX – LINEAR ALGEBRA**OBJECTIVES:**

- To facilitate a better understanding of vector space.
- To acquire problems solving ability in linear algebra.

COURSE OUTCOMES:

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

1. Define and illustrate Vector Spaces, Subspaces and Linear Transformations.
2. Define Linear independence, Basis and dimension.
3. Define Inner Product Space and Orthogonality.
4. Describe Theory of Matrices.
5. Find the Characteristic equation, Eigen values and vectors.

UNIT – I

Vector Space: Definition and Example – 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 Example – Orthogonality – Orthogonal Complement – Gram Schmidt orthogonalization process.

UNIT – IV

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

UNIT – V

Matrices: Test for consistency – Solving Linear Equations – CayleyHamilton theorem – Uses of CayleyHamilton theorem – Inverse and power of a matrix -Eigenvalues and Eigenvectors

Bilinear forms: Bilinear forms- Quadratic forms.

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 7.5
UNIT – V	Chapter – 7	Sections 7.6& 7.8
	Chapter – 8	Sections 8.1& 8.2

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			
V	22UMA5CC9	LINEAR ALGEBRA					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(✓) = 40 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	2	2	2	25	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – V

Course Code: 22UMA5CC10

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE – X –REAL ANALYSIS**OBJECTIVES:**

- To provide the basic knowledge of Continuity, Differentiability and Integrability of real functions.
- To acquire the knowledge of Riemann Integration.

COURSE OUTCOMES:

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

1. Study various types of axioms and Properties of the supremum.
2. Define Neighbourhoods, Open sets, closed sets and Limit points of a set.
3. Determine the Continuous functions, Uniform continuous and Types of discontinuities.
4. Identify the continuity of a function defined on metric spaces
5. Define and illustrate the concept of Riemann integral.

UNIT – I

Real Number system: The field axioms- the order axioms - Geometric representation of real numbers- the rational numbers-the irrational numbers-upper bounds- maximum element- least upper bound (supremum)-The completeness axiom- some properties of the supremum- Absolute values - The triangle inequality- the Cauchy Schwarz's inequality.

UNIT – II

Elements of point set Topology: Euclidean space -Open sets and closed sets– BolzanoWeierstrass theorem- The Cantor Intersection Theorem– Coverings – Lindelofcovering theorem.

UNIT – III

Continuous functions on metric spaces: Functions continuous at a point on the real line - Functions continuous in a metric space - Discontinuous function on \mathbb{R}^1 .

UNIT – IV

Connectedness, Completeness and Compactness: Connectedness- Bounded sets and totally bounded sets- Complete metric spaces - Continuous functions on compact metric spaces -Continuity of the inverse function-Uniform continuity.

UNIT – V

Riemann Integral: Existence of the Riemann integral- Derivatives -Rolle's theorem - Fundamental theorem of Calculus –Mean value theorem- Cauchy's Mean Value theorem-Taylor's Theorem.

TEXT BOOK(S):

1. Tom M. Apostol - Mathematical Analysis, II Edition, Narosa Publishing House, New Delhi (Unit I), (1997).
2. Goldberg. R. - Methods of Real Analysis Oxford and IBH Publishing Co. New Delhi (2000).

UNIT – I	Chapter – 1	Sections 1.1 to 1.4, 1.8 to 1.12, 1.18 to 1.19 of [1]
UNIT – II	Chapter – 3	Sections 3.1 to 3.10 of [1]
UNIT – III	Chapter –5	Sections 5.1 to 5.6 of [2]
UNIT – IV	Chapter –6	Sections 6.1 to 6.8 of [2]
UNIT – V	Chapters–7 & 8	Sections7.1 to 7.8 & 8.5 of [2]

REFERENCE(S):

1. ViswanathaNaik, K ,Real Analysis, Emerald Publishers,Chennai.
2. M.K,Singhal&Asha Rani Singhal , A First Course in Real Analysis, R.Chand& Co., June 1997 Edition

Web Link:

1. <https://biblio.sg/book/real-analysis-k-viswanatha-naik/d/501884680>
2. <https://www.scribd.com/doc/110873574/Bsc-Maths-Subjects>
3. <https://www.pdfdrive.com/a-first-course-in-real-analysis-d165013535.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
V	22UMA5CC10	REAL ANALYSIS					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(✓) = 40 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
35	0	0	0	35	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – V

Course Code: 22UMA5CC11

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

1. Gains knowledge about the nature of forces.
2. Acquire knowledge regarding the objects at rest.
3. Be aware of friction and its various forms.
4. Be familiar with centre of gravity.
5. Explain Types of forces and Equilibrium of a uniform homogeneous string.

UNIT – I

Forces acting on a particle: Forces-types of forces-Triangle law of forces- equilibrium of forces acting on a particle - 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: Reduction of a system of forces - Equilibrium of three forces acting on a rigid body.

UNIT – III

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

UNIT – IV

Centre of Gravity: Location of the centre of gravity - Methods of Symmetry and methods by integration.

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, 14th Edition. 2011.

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

UNIT – IV	Chapter – 8	Sections 1 to 18
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
2. 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	22UMA5CC11	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(✓) = 39 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	0	0	0	21	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – V

Course Code: 22UMA5CC12

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – XII–PROGRAMMING IN C**OBJECTIVES:**

- To know basic concepts of computer programming in C.
- To know how to write Programmes using C for numerical computing

COURSE OUTCOMES:

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

1. Study the concept of C character set, identifiers and key words, variable names
2. Understand input and output operations.
3. Gain knowledge about different types of statements
4. Be familiar with decision making and looping.
5. Implement different operations on arrays and Strings.

UNIT – I

Constants, Variables and Data Types: Introduction-Basic Structure of C Programme – Character Set – Constants – Key Words and Identifiers – Variables – Data Types – Declaration of Variables – Assigning Values to Variables– Defining Symbolic Constants.

Operators and Expressions: Arithmetic Operators – Relational Operators – Logical Operators – Assignment Operators – Increment and Decrement Operators – Conditional Operators –Special Operators - Arithmetic Expressions – Evaluation of Expressions – Type Conversations in Expressions.

UNIT – II

Managing Input and Output Operations: Reading and Writing Character – Formatted Input and Output.

UNIT – III

Decision Making and Branching: Decision making with If statement – the If.... Else statement – Nesting of If... Else Statement – the Switch Statement – the GO TO Statement.

UNIT – IV

Decision Making and Looping: The While Statement – Do While Statement – For Statement- Jumps in Loops.

UNIT – V

Arrays:OneDimensional Arrays - Two Dimensional Arrays- Initializing – TwoDimensional Array – Multi Dimensional Arrays

Character Arrays and Strings: Declaring and Initializing String Variables – Reading String from Terminal – Writing Strings on the Screen – Arithmetic Operations on Characters.

TEXT BOOK:

- E. Balagurusamy, "Programming in ANSI C", Fifth Edition, Tata McGraw Hill.

UNIT – I	Chapter – 1	Sections 1.1, 1.2 & 1.8
	Chapter – 2	Sections 2.2 to 2.11
	Chapter – 3	Sections 3.1 to 3.11 & 3.14
UNIT – II	Chapter – 4	Sections 4.1 to 4.5
UNIT – III	Chapter – 5	Sections 5.1 to 5.9
UNIT – IV	Chapter – 6	Sections 6.1 to 6.5
UNIT – V	Chapter – 7	Sections 7.1 to 7.7
	Chapter – 8	Sections 8.1 to 8.5

REFERENCE(S):

- B.W. Kernighan and D.M. Ritchie, "The C Programming Language", 2nd Edition, PHI, 1988.
- H. Schildt, "C: The Complete Reference", 4th Edition. TMH Edition, 2000.
- Gottfried B.S., "Programming with C", Second Edition, TMH Pub. Co. Ltd., New Delhi 1996.
- Kanetkar Y., "Let us C", BPB Pub., New Delhi, 1999.

Web Link:

- https://ia802802.us.archive.org/15/items/The_C_Programming_Language/The_C_Programming_Language.pdf
- https://docs.google.com/file/d/0B3OzFFMgEP0tU3RVcmh2Wm5ZUWs/edit?resourcekey=0-wQuLS_uE4BCJL70xs-1JKQ
- <https://www.codewithc.com/programming-with-c-pdf-byron-gottfried/>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	22UMA5CC12	PROGRAMMING IN C					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(✓) = 33 Relationship: Moderate											
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		

Total	Number of Topics	Category
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Number of Topics	Local	Regional	National	Global	Based on %
40	0	0	0	40	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – V

Course Code: 22UMA5MBE1:1

Instruction Hours: 4

Credits: 3

Exam Hours: 3

Internal Marks: 25

External Marks: 75

MAJOR BASED ELECTIVE – I– NUMERICALMETHODS

OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Compute the Solution of Algebraic and Transcendental equation using Bisection, Method of false position and Newton- Raphson Method.
2. Find the solution of linear system of equation by Gaussian Elimination, Gauss Jacobi, and Gauss Seidel Methods
3. Solve Interpolation of Finite differences – Newton’s Forward, Central and Backward differences
4. Obtain the Numerical differentiation and integration.
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 Raphson Method.

UNIT – II

Solutions to Linear Systems: Introduction- Gaussian Elimination Method- GaussJordan Elimination Method- Iterative methods–GaussJacobi 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 – Backward Differences to compute derivatives-Numerical Integration using Trapezoidal rule- Simpson’s onethird-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 2nd and 4th 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.
3. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt.Limited, 4th Edition, 2009.

Web Link:

1. <https://nptel.ac.in/courses/111/107/111107105/>
2. <https://freevideolectures.com/course/3504/numerical-methods-of-ordinary-and-partial/1>
3. <https://www.classcentral.com/course/swayam-numerical-methods-for-engineers-14213>
4. <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				
V	22UMA5MBE1:1	NUMERICAL METHODS					4	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(✓) = 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

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

Topics					
30	0	0	0	30	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – V

Course Code: 22UMA5MBE1:2

Exam Hours: 3

Instruction Hours: 4

Internal Marks: 25

Credits: 3

External Marks: 75

MAJOR BASED ELECTIVE – I – DISCRETE MATHEMATICS

OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Understand the concepts of mathematical logics such as connections, concept of tautology, etc.,
2. Gains knowledge in disjunctive and conjunctive normal forms.
3. Study the concepts of predicate calculus, Relations and ordering.
4. Learn about partially ordered the set, lattices and their types.
5. Understand Boolean algebra and Boolean functions.

UNIT – I

Statement and notation:Connectives– Negative – Conjunctive – Disjunctive – Statement Formulae and Truth tables – Conditional and Bi conditional statements– Well defined formulae – Tautologies– Other connectives.

UNIT – II

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

UNIT – III

Inference theory of the predicate calculus –Relations and ordering.

UNIT – IV

Lattice as partially ordered set: 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 to 1.2.4, 1.2.6 to 1.2.8, 1.2.14

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]

	Chapter – 2	Sections 2.3.1 to 2.3.5, 2.3.7 & 2.3.8
UNIT – IV	Chapter – 4	Section 4.1
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	22UMA5MBE1:2	DISCRETE MATHEMATICS					4	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(✓) = 32 Relationship: MODERATE												

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

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

Topics					
26	1	1	1	26	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – V

Course Code: 22UMA5MBE1:3

Instruction Hours: 4

Credits: 3

Exam Hours: 3

Internal Marks: 25

External Marks: 75

MAJOR BASED ELECTIVE – III – MS OFFICE

OBJECTIVES

- To know the basic knowledge of computer
- To study word, excel and power point.

COURSE OUTCOMES:

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

1. Acquire the basic knowledge of creating a document.
2. Formatting a document Turning Bold on/off, Underline on/off, highlight on/off-changing font size.
3. Working with basic functions SUM, AVERAGE, MAX and MIN.
4. Simple calculations using mathematical, statistical, logical functions.
5. Gain the knowledge of creating a simple presentation.

UNIT – I

MS Word Creating a document-saving, printing, editing and closing the document -copying, pasting, finding and replacing a text -adding headers and footers

UNIT – II

Formatting a document-Turning Bold on/off, Underline on/off, highlight on/off-changing font size, page setup-changing margins-bullets and numbering - working with tables-changing the column width and row height-inserting or deleting a row/column- mailmerge

UNIT – III

MS Excel Creating a worksheet-entering, editing, deleting data in cells-saving and previewing the worksheet- entering formulas, working with basic functions SUM, AVERAGE, MAX and MIN sorting

UNIT – IV

Formatting a worksheet-inserting, deleting a row/column changing font size - Graphs and charts - Simple calculations using mathematical, statistical, logical functions

UNIT –V

MS Power point Creating a simple presentation - adding transition effects to a presentation-adding sound effects to a presentation - creating hyperlinks between slides-changing the background - inserting images on slides.

TEXT BOOK

Dr.P.Rizwan Ahmed, “Office Automation 2010”, Margham Publications 2016

REFERENCE BOOK(S)

1. Stephen .L . Nelson, “Office 2010, Computer Reference”, Tata McGraw Hill Publishing company Ltd.
2. Sumner Mary- “Enterprise Resource Planning”, Pearson Education, inc. I Edition 2012.

Web link

1. <https://www.pdfdrive.com/microsoft-office-2010-advanced-e189145902.html>
2. <https://www.pdfdrive.com/concepts-in-enterprise-resource-planning-e29021375.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
V	22UMA6MBE1:3	MS OFFICE					4	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 (✓) = 35 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
27	0	0	0	27	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – V

Course Code: 22UMA5SBE2:1

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

SKILL BASED ELECTIVE –II

MATHEMATICS FOR COMPETITIVE EXAMINATION – II

OBJECTIVES:

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

COURSE OUTCOMES:

1. Solve the problems based on Chain Rule, Time and work, Pipes and Cisterns.
2. Understand problems on distance and trains.
3. Solve the problems based on Simple Interest and Compound Interest.
4. Understand Problems on Volume and Surface Area.
5. Find Permutations and Combinations

UNIT – I

Chain Rule – Time and Work – Pipes and Cisterns

UNIT – II

Time and Distance – Problems on Trains – Boats and Streams.

UNIT – III

Simple Interest – Compound interest- Stocks and Shares.

UNIT – IV

Clocks – Area – Volume and Surface Area.

UNIT – V

Permutations and Combinations.

Text Book:

1. Scope and treatment as in “Quantitative Aptitude “by R.S.Aggarwal, S.Chand & company limited, Ram Nagar, New Delhi - 2015

UNIT – I

Chapters - 14, 15 & 16

UNIT – II	Chapters - 17&18
UNIT – III	Chapters -21, 22 & 29
UNIT – IV	Chapters - 24, 25 & 28
UNIT – V	Chapter -30

Web Link:

1. <https://www.pdfdrive.com/quantitative-aptitude-and-reasoning-e187540802.html>
2. <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				
V	22UMA5SBE2:1	MATHEMATICS FOR COMPETITIVE EXAMINATION – II					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(✓) = 40 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
13	1	3	11	8	National

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – V

Course Code: 22UMA5SBE2 :2

Instruction Hours: 2

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

SKILL BASED ELECTIVE – II

LATEX THEORY

OBJECTIVES:

- To introduce the LATEX concepts.
- To develop the typing skills through Latex.

COURSE OUTCOMES:

1. To introduce Sample document and Key Concepts.
2. Understand the Typesetting Mathematics.
3. Gain the knowledge of Symbols for number sets.
4. To Develop Document classes and the overall structure.
5. Acquire knowledge Miscellaneous extras.

UNIT – I

Basic LaTeX – Sample document and Key Concepts – type style – environments – Lists – Centering – tables – verbatim – vertical and horizontal spacing. (Chapter 2 Sections 2.1. to 2.4.)

UNIT – II

Typesetting Mathematics – Examples – Equation environments – Fonts, hats and underlining – braces – arrays and matrices – Customized commands – theorems like environments. (Chapter 3 Sections 3.1. to 3.7.)

UNIT – III

Math miscellany – Math Styles – Bold Math – Symbols for number sets – binomial coefficient. (Chapter 3 Sections 3.8. to 2.4.)

UNIT – IV

Further essential LaTeX – Document classes and the overall structure – titles for documents – Sectioning commands. (Chapter 4 Sections 4.1. to 4.3.)

UNIT – V

Miscellaneous extras – Spacing – Accented characters – Dashes and hyphens – quotation marks – trouble shooting – Pinpointing the error – common errors– warning messages. (Chapter 4 Sections 4.4 to 4.5.)

TEXT BOOKS

1. David F Griffiths and Desmond J. Higham, Learning LaTeX, SIAM (Society for Industrial and Applied Mathematics) Publishers, Philadelphia, 1996.

REFERENCE BOOKS

1. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.
2. L. Lamport. LATEX: A Document Preparation System, User's Guide and Reference Manual. Addison Wesley, New York, second edition, 1994 Note:

Web Link:

1. <https://www.perlego.com/book/1692209/a-students-guide-to-the-study-practice-and-tools-of-modern-mathematics-pdf>
2. <https://www.pdfdrive.com/latex-a-document-preparation-system-e158590804.html>

Semester	Code	Title of the Course					Hours	Credits			
V	22UMA5SBE2:2	LATEX THEORY					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 (✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
35	2	2	8	25	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – V

Course Code: 22UMA5SBE3:1

Instruction Hours: 2

Credits: 2

Exam Hours: 3

Internal Marks: 40

External Marks: 60

SKILL BASED ELECTIVE – III

NUMERICAL METHODS WITH MATLAB – PRACTICAL

OBJECTIVES:

- To introduce the exciting world of programming to the students through numerical methods.
- To solve the techniques of MATLAB programming

COURSE OUTCOMES:

1. To introduce the exciting world of programming to the students through numerical methods.
2. To introduce the techniques of MATLAB programming.
3. To solve numerical problems using MATLAB programming.
4. To solve R.K fourth order method.
5. To introduce lagrange's method of interpolation.

LIST OF PRACTICALS

1. Linear Interpolation
2. Linear Regression
3. Curve Fitting
4. Trapezoidal rule of integration
5. Simpson's 1/3 rule of integration
6. Newton – Raphson method of solving equations
7. Gauss – elimination method of solving simultaneous equations
8. Gauss – Seidal method of solving simultaneous equations
9. R-K fourth order method of solving differential equations
10. Lagrange's method of interpolation.

Web Link:

1. <https://www.youtube.com/watch?v=XQo7tT3FWQk&list=PLdWHbcKoQW75BCG2tmvPVC-iHRmVPcE6Q>

2. <https://www.youtube.com/watch?v=lnXh3XTmuVs>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	22UMASBE3:1	NUMERICAL METHODS WITH MATLAB - 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 (✓) = 35					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						

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
10	1	1	1	7	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – V

Course Code: 22UMA5SBE3:2
Instruction Hours: 2
Credits: 2

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

SKILL BASED ELECTIVE – III LATEX PRACTICALS

OBJECTIVES:

- To develop the typing skills through Latex.
- To know given expression using all inequalities

COURSE OUTCOMES:

1. To Type a Document in different alignments.
2. To Type our own Bio – Data.
3. Gain the knowledge of type of given Article.
4. To Develop Document classes and the overall structure.
5. Acquire knowledge to convert one Latex file into power point presentation.

LIST OF PRACTICALS

Write Latex program for the following

1. Type a Document in different alignments (Left, Right, Center, Justify).
2. Type a Letter for applying a job.
3. Type your own Bio – Data.
4. Draw a Table structure.
5. Type a given Mathematical expression using Differentiation, Integration and Trigonometry.
6. Type a given Mathematical expression using all expression.
7. Type a given expression using all inequalities.
8. Type of given Article.
9. Draw any picture and insert in LateX file.
10. Type a given Question paper
11. Convert one LateX file into power point presentation.

TEXT BOOKS

- David F Griffiths and Desmond J. Higham, Learning LaTeX, SIAM (Society for Industrial and Applied Mathematics) Publishers, Philadelphia, 1996.

REFERENCE BOOKS

- Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.
- L. Lamport. LATEX: A Document Preparation System, User's Guide and Reference Manual. Addison Wesley, New York, second edition, 1994

Web Link:

- <https://www.pdfdrive.com/latex-a-document-preparation-system-e158590804.html>
- <https://www.youtube.com/watch?v=Jp0lPj2-DQA>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	22UMASBE3:2	LATEX PRACTICALS					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 (✓) = 35						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						

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

11	1	1	2	7	Global
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Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – VI

Course Code: 22UMA6CC13

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 6

External Marks: 75

CORE COURSE – XIII –COMPLEX ANALYSIS

OBJECTIVES:

- To understand the knowledge about the types of singularity of a complex function.
- To promote the knowledge of problem solving abilities in residues.

COURSE OUTCOMES:

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

1. Understanding and significance of Limits, Continuous functions and Differentiability for complex function and be familiar with the CR-equation.
2. Define Bilinear transformations, Cross ratio and Fixed points.
3. Use Cauchy's integral Theorem and formula to compute line integral.
4. Represent functions as Taylor's series and Laurent's series.
5. Find Residues and evaluate complex integral using Cauchy's Residue Theorem.

UNIT – I

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

UNIT – II

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

UNIT – III

Definite integral – Cauchy's Theorem – Cauchy's integral formula.

UNIT – IV

Taylor's Series– Example– Laurent's series – Zeros of an analytic functions –Singularities.

UNIT – V

Residue -Cauchy's residues theorem –Argument theorem– Rouché's theorem – Fundamental theorem of algebra– Problems –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 2.1 to 2.8

UNIT –II Chapter– 3 Sections 3.1 to 3.4

UNIT– III	Chapter–6	Sections 6.1 to 6.3
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	22UMA6CC13	COMPLEX ANALYSIS					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(✓) = 42 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

Total	Number of Topics	Category
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Number of Topics	Local	Regional	National	Global	Based on %
24	2	2	2	24	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – VI

Course Code: 22UMA6CC14

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – XIV –DYNAMICS

OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Gains knowledge regarding Projectiles.
2. Acquire knowledge on impact of a particle on a surface.
3. Study the concept of simple harmonic motion.
4. Be familiar with central orbits.
5. Understand the moment of inertia.

UNIT – I

Projectiles:Equation of Path - Range - Maximum height - Time of flight - Characteristics - Range on an inclined plane -Motion on 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- Two Fold problems - 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, 14th Edition, July 2011.

UNIT – I Chapter – 6 Sections 6.2 to 6.16

UNIT – II Chapter –8 Sections 8.1 to 8.9

UNIT – III	Chapter – 10	Sections 10.1 to 10.7
UNIT – IV	Chapter – 11	Sections 11.1 to 11.11 & 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
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	22UMA6CC14	DYNAMICS					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(✓) = 39 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	0	0	0	24	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – VI

Course Code: 22UMA6CC15

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE –XV – GRAPH THEORY

OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Describe the origin of graph theory
2. Understand Eulerian and Hamiltonian graphs.
3. Study about Bipartite graph.
4. Demonstrate Matrix Representation of graphs.
5. Derive some properties on Planar and dual graphs.

UNIT – I

Basics: Graphs – Pictorial representation – Subgroups – Isomorphism and degrees – Walks and connected graphs– Cycles in graphs – Cut-vertices and cut-edges.

UNIT – II

Eulerian and Hamiltonian Graphs: Eulerian graphs – Fleury’s algorithm – Hamiltonian graphs – weighted graphs.

UNIT – III

Bipartite Graphs and Matrices: Bipartite graphs – Marriage problem – Trees –Connector problem

UNIT – IV

Matrices and Vector Spaces Associated with Graphs:Matrix representations – Vector spaces associated with graphs – Cycle space – cut-set space.

UNIT – V

Planar Graphs: Planar Graphs– Euler formula –Platonic solids– Dual of a plane graph – Characterization of planar graphs.

TEXT BOOK:

1. Choudum.S.A. – A First Course in Graph Theory, Macmillan India Limited, 2000.

UNIT – I

Chapter – 1

Sections 1.1 to 1.7

UNIT – II	Chapter – 2	Sections 2.1 to 2.4
UNIT – III	Chapter – 3	Sections 3.1 to 3.4
UNIT – IV	Chapter – 4	Sections 4.1 to 4.4
UNIT – V	Chapter – 5	Sections 5.1 to 5.5

REFERENCE(S):

1. Murugan.M – Introduction to Graph Theory, Muthali Publishing House, Chennai, 2005.
2. Arumugam.S and S. Ramachandran, - Invitation to Graph Theory, Scitech publications India Pvt. Limited, Chennai – [2001, Edition].

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	22UMA6CC15	GRAPHTHEORY					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(✓) = 39 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	0	0	0	24	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – VI

Course Code: 22UMA6MBE2:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

MAJOR BASED ELECTIVE – II – OPERATIONSRESEARCH

OBJECTIVE:

- To introduce the techniques of Operations Research
- To acquire the knowledge of Network and Game theory.

COURSE OUTCOMES:

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

1. Illustrate General Linear Programming Problem by Simplex Method and Big-M Method of LPP.
2. Find Initial Basic Feasible Solution to the Transportation Problem by using North West Corner Rule, Matrix Minima Method and VAM –MODI Method
3. Understand various method of solving Assignment problems.
4. Become familiar with various terms and rules used in theory of games.
5. Define basic components of Network and critical path.

UNIT – I

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

UNIT – II

Transportation Problem: North-West Corner Rule - Matrix Minima method - Vogel's Approximation Method - MODI Method - Degeneracy and Unbalanced Transportation Problem.

UNIT – III

Assignment Problem: Hungarian Method - Unbalance Assignment Problem - Travelling Salesman Problem.

UNIT –IV

Games and Strategies: Two Person Zero sum Games - The Maximin Principle - 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: Network - basic components - Rules of Network Construction - Time Calculation in network- Critical Path Method - PERT Calculation.

TEXT BOOK:

1. KantiSwaroop, Gupta.P.K,&Manmohan, Operations Research, Sultan Chand & Co, 16thRevised Edition.

UNIT – I	Chapters – 2,3& 4	Sections 2.1 to 2.3,3.2 to 3.3& 4.3, 4.4
UNIT – II	Chapter – 10	Sections 10.1, 10.2, 10.9 to10.13
UNIT – III	Chapter – 11	Sections 11.1 to 11.4&11.7
UNIT – IV	Chapter – 17	Sections 17.1 to 17.7
UNIT – V	Chapter – 25	Sections 25.1 to 25.7

REFERENCE(S):

1. Hamdy A. Taha, Operations Research, 7th 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			
VI	22UMA6MBE2:1	OPERATIONS RESEARCH					6	4			
Course Outcomes (COs)	ProgrammeOutcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓			✓	✓		✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO4		✓	✓	✓		✓	✓	✓	✓		
CO5		✓	✓	✓	✓	✓	✓	✓	✓		
Number of Matches(✓) = 40 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	0	0	0	25	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – VI

Course Code: 22UMA6MBE2:2
 Instruction Hours: 6
 Credits: 4

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

MAJOR BASED ELECTIVE– II – ASTRONOMY

OBJECTIVES:

- To provide knowledge about the universe, scientific thinking to problems in astronomy
- To study the observational foundations of astronomy's greatest discoveries and the nature of galaxy.

COURSE OUTCOMES:

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

1. Understand spherical trigonometry.
2. Study morning and evening stars, Zones of earth and perpetual day.
3. Study laws of refraction, geocentric and Heliocentric Parallax.
4. Distinguish Kepler's laws .
5. Understand the concept of Lunar, solar eclipses, Maximum and minimum number of eclipses in a year.

UNIT – I

Spherical Trigonometry: Spherical Triangle - The fundamental formulae of Spherical Trigonometry-the sine – cosine - four parts and Napier formulae (without proof).

UNIT – II

The Celestial Sphere: Celestial coordinators - Diurnal motion - Rising and setting of a star - Sidereal time - Circumpolar star - Morning and Evening stars - Twilight - Earth - Length of the day.

UNIT – III

Refraction - Tangent Formula – Cassini's formula - Effects of Refraction - Geocentric Parallax - Effects of Geocentric Parallax- Heliocentric Parallax - Effects of Heliocentric Parallax - Aberration - Its Effects.

UNIT – IV

Kepler's Laws - Verification of Kepler's Laws - True anomaly -Mean Anomaly- Eccentric Anomaly- Relation between them- Time - Equation of Time - Seasons - Conversion of Time.

UNIT – V

Moon - Sidereal Month - Lunation and Relation between them - Phases of the Moon - Lunar Libration - Surface of the Moon - Metonic Cycle - Tides - Eclipses - Shadow Cone - Minimum and Maximum number of Eclipses.

Planetary Phenomena - Bodes law - Elongation - Sidereal Period - Synodic period and the relation between them - Phase - Stationary Points.

TEXT BOOK:

1. S. Kumaravelu and Prof. SusheelaKumaravelu, Astronomy, SKV Publications, 2014

UNIT – I	Chapter –1	[Pages 1 to 40]
UNIT – II	Chapters – 2 & 3	[Pages 41 to 153]
UNIT – III	Chapters – 4 & 5	[Pages 154 to 190]
UNIT – IV	Chapters – 6 & 7	[Pages 191 to 246]
UNIT – V	Chapters – 12, 13 & 14	

REFERENCE:

1. V. Thiruvengkatacharya, A Text Book of Astronomy, S. Chand and Co., Pvt Ltd., 1972.
2. Ramachandran. G.V. - Astronomy
3. George.O.Abell - Exploration of the Universe (Second Edition).

Web link:

1. <https://www.pdfdrive.com/fundamental-astronomy-e176020741.html>
2. <https://d3bxy9euw4e147.cloudfront.net/oscms-qa/media/documents/Astronomy-LR.pdf>
3. <https://www.pdfdrive.com/astronomy-the-solar-system-and-beyond-e34358759.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	22UMA6MBE2:2	ASTRONOMY					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(✓) = 33 Relationship: MODERATE											

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
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Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
52	0	0	0	52	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – VI

Course Code: 22UMA6MBE2:3

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

MAJOR BASED ELECTIVE – II – CODING THEORY

OBJECTIVES:

- To introduce the fundamental concepts of Coding Theory
- To enlighten the students with applications of the subject.

COURSE OUTCOMES:

1. Understand the Communication channels.
2. Study Nearest neighbour / minimum distance decoding.
3. Gain knowledge about Structure of finite fields.
4. Distinguish Vector spaces over finite fields.
5. Understand Nearest neighbour decoding for linear codes – Syndrome decoding.

UNIT – I

Error detection, correction and decoding: Communication channels– Maximum Likelihood decoding.

UNIT II

Hamming distance – Nearest neighbour /minimum distance decoding – Distance of a code.

UNIT III

Finite Fields: Finite fields– Polynomial rings– Structure of finite fields - Minimal Polynomials.

UNIT IV

Linear codes: Vector spaces over finite fields- Linear Codes -Hamming weight – Bases for linear codes.

UNIT V

Generator matrix and parity - Check matrix– Equivalence of linear codes – Encoding with a linear code – Decoding of linear codes – Cosets –Nearest neighbour decoding for linear codes – Syndrome decoding.

TEXT BOOK:

San Ling and Chaoping Xing, Coding Theory: A first course, Cambridge University Press (2004).

UNIT I	Chapter 1 &2	Sections 2.1 – 2.2
UNIT II	Chapter 2	Sections 2.3 – 2.5
UNIT III	Chapter 3	
UNIT IV	Chapter 4	Sections 4.1 – 4.4
UNIT V	Chapter 4	Sections 4.5 – 4.8

REFERENCE(S):

1. D.G. Hoffman et al, Coding Theory and Cryptography – The Essentials, Marcel DekkerINC., Second Edition, (2000).
2. J.H. Van Lint, Introduction to Coding Theory, Springer, (1998).

Web Link:

1. <https://www.pdfdrive.com/introduction-to-cryptography-with-coding-theory-e158116372.html>
2. <https://ia800200.us.archive.org/28/items/1999IntroductionToCodingTheory/1999%20%20Introduction%20to%20Coding%20Theory.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
VI	22UMA6MBE2:3	CODING THEORY					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 (✓) = 33						Relationship: MODERATE						

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
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Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	0	0	0	21	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – VI

Course Code: 22UMA6MBE3:1

Exam Hours: 3

Instruction Hours: 5

External Marks : 100

Credits: 4

MAJOR BASED ELECTIVE – III – MINI PROJECT

COURSE OUTCOMES (CO):

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

1. Identify the requirements for the real world problems.
2. Conduct a survey of several available literatures in the preferred field of study.
3. Study and enhance software/ Theoretical skills
4. To report and present the findings of the study conducted in the preferred domain

- 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 group.
- Each group is limited to maximum of four students.
- Mini Projects must be implemented using latest technology.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – VI

Course Code: 22UMA6MBE3:2

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

MAJOR BASED ELECTIVE – III –ELEMENTARY NUMBER THEORY

OBJECTIVES:

- To introduce the Diophantine equations, Congruences, Euler's functions.
- To develop the problem solving skill in residue systems

COURSE OUTCOMES:

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

1. Acquire the basic knowledge of Peano's Axiom and the Binomial Theorem.
2. Describe Division Algorithm and the Diophantine Equation $ax+by=c$.
3. Define Primes and Their Distribution and prove Eratosthenes.
4. Discuss the properties of Congruence and prove the Chinese Remainder Theorem.
5. Write Fermat's Theorems, Wilson's Theorem.

UNIT – I

Peano's Axiom - Mathematical Induction - The Binomial Theorem.

UNIT – II

Divisibility Theory in Integers - The Division Algorithm - The G.C.D. - Enclidean Algorithm - The Diophantine Equation $ax + by = c$

UNIT – III

Primes and their Distributions - The fundamental Theorem of Arithmetic - The seive of Eratosthenes - The Gull Conjecture.

UNIT – IV

The Theory of Congruence - Basic Properties of Congruence - Special divisibility test - Linear Congruence.-Prime modulus- Power residues.

UNIT –V

Fermat's Theorem - The Little theorem - Wilson's theorem.

TEXT BOOK:

1. Kumaravelu. S and SusheelaKumaravelu – Elements of Number Theory, Nagarcoil, 2002.

UNIT – I	Chapter – 1	Sections 3 to 25, 60
UNIT – II	Chapters – 2 & 11	Sections 61 to 76 & 304 to 307
UNIT – III	Chapters – 4 & 5	Sections 77 to 87 & 140 to 415
UNIT – IV	Chapter – 6	Sections 155 to 168, 178 to 188
	Chapters – 8 & 9	Sections 222 to 223, 227 to 228 & 229 to 249
UNIT – V	Chapter – 7	Sections 191 to 205

REFERENCE:

1. George E. Andrews, Number Theory, Dover publications, INC, New York (1994).

Web link:

1. <https://www.pdfdrive.com/number-theory-an-introduction-to-mathematics-e19118551.html>
2. <https://www.perlego.com/book/110806/number-theory-pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
VI	22UMA6MBE3:2	ELEMENTARY NUMBER THEORY					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(✓) = 35 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
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Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	0	0	0	21	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – VI

Course Code: 22UMA6MBE3:3

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

MAJOR BASED ELECTIVE – I – MATHEMATICAL MODELING

OBJECTIVES:

- To study the mathematical models through ode and difference equations.
- To train the students to develop mathematical models in real life problems.

COURSE OUTCOMES:

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

1. Understand the concepts of Linear Growth and Decay Models \
2. Gains knowledge in Population Dynamics.
3. Study the concepts of Mathematical Modelling through Linear Differential Equations of Second Order.
4. Using the concept of Population Dynamics and Genetics.
5. Understand Solutions that can be Modeled Through Graphs.

UNIT – I

Mathematical Modeling through Ordinary Differential Equations of First order:

Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

UNIT - II

Mathematical Modeling through Systems of Ordinary Differential Equations of First Order:

Population Dynamics – Epidemics – Compartment Models – Economics – Medicine - Arms Race - Battles - International Trade – Dynamics.

UNIT - III

Mathematical Modeling through Ordinary Differential Equations of Second Order:

Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order –Miscellaneous Mathematical Models.

UNIT - IV**Mathematical Modeling through Difference Equations:**

Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

UNIT - V**Mathematical Modeling through Graphs:**

Solutions that can be Modeled Through Graphs– Mathematical Modeling in Terms of Directed Graphs - Signed Graphs -Weighted Digraphs and Unoriented Graphs.

TEXT BOOK:

1. J.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Delhi, 1988.

UNIT - I Chapter – 2 Section 2.1 to 2.6

UNIT - II Chapter – 3 Section 3.1 to 3.6

UNIT - III Chapter – 4 Section 4.1 to 4.4

UNIT - IV Chapter – 5 Section 5.1 to 5.5

UNIT - V Chapter – 7 Section 7.1 to 7.5

REFERENCE:

1. J.N. Kapur, Mathematical Models in biology and Medicine, EWP, New Delhi, 1985.

Web Link:

1. <https://www-m6.ma.tum.de/~kuttler/script1.pdf>
2. https://sysbio.mx/wp-content/uploads/2021/02/MATHEMATICAL-MODELS-IN-BIOLOGY_Allman.pdf

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	22UMA5MBE3:3	MATHEMATICAL MODELLING					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 (✓) = 32						Relationship: MODERATE					

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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
27	0	0	0	27	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

ALLIED MATHEMATICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2022 - 2023 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)

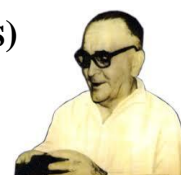


THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B⁺⁺)

(Affiliated to Bharathidasan University, Tiruchirappalli)

ELAMBALUR, PERAMBALUR – 621 220



Question Paper Pattern

Mathematics Programme		
Maximum Marks : 75		Duration: 3 Hours
Part – A	20 Multiple Choice Questions	20 x 1 = 20 Marks
Part – B Paragraph	5 Questions (Internal Choice) One set of questions from each unit	5 x 5 = 25 Marks
Part – C Essay Type	3 Questions (Answer any 3 out of 5 Questions) One question from each unit	3 x10 = 30 Marks
Total		75 Marks

MODEL QUESTION PAPER:

BSC/ BCASEMESTER EXAMINATIONS

Time: 3 Hours Maximum Marks - 75

SECTION – A

Answer **ALL** of the Following

(10 X 2 = 20 Marks)

SECTION – B

Answer **ALL** of the Following

(5 X 5 = 25 Marks)

SECTION – C

Answer any **THREE** of the Following

(3 X 10 = 30 Marks)

Computer Application

(For the candidates admitted from the academic year 2022 - 2023 onwards)

ALLIED MATHEMATICS

ALLIED COURSE -I -NUMERICAL METHODS AND STATISTICS

Course Code: **22UMA1AC1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To train the students in the numerical problems.
- To understand the knowledge in solving statistical problems.

COURSE OUTCOMES

1. Evaluate algebraic and transcendental equation using numerical methods.
2. Find the solution of linear system of equation by Gaussian Elimination, Method of Factorization, Gauss Jacobi and Gauss Seidel Methods.
3. Evaluate finite integrals using Trapezoidal and Simpson's rule and Solve differential equation and integration.
4. Categorize and evaluate various measures of central tendency.
5. Calculate correlation and regression.

UNIT – I

The Solution of Numerical Algebraic and Transcendental Equations: Bisection Method - Iteration Method – Regula Falsi Method - Newton Raphson Method – **Simple Problems only.**

UNIT – II

Solutions of Simultaneous Linear Algebraic Equations: Gauss Elimination Method– Gauss Jordan Method - Gauss Jacobi - Gauss Seidel Method.

UNIT – III

Numerical solution of ODE: Taylor Series Method - Euler's Method - Runge– Kutta Second and Fourth order method

Numerical Integration: Trapezoidal Rule - Simpson's Rule (Proof not needed).

UNIT – IV

Measures of Central Tendency: Arithmetic Mean – Median – Mode – Geometric Mean – Harmonic Mean. **Measures of Dispersion:** Range – Quartile Deviation - Standard Deviation.

UNIT – V

Correlation and Regression: Introduction – Scatter Diagram - Karl Pearson Co-efficient of Correlation – Rank Correlation - Lines of Regression- **Simple Problems only.**

TEXT BOOK(S):

1. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Pvt.Ltd, New Delhi 2010.
2. Gupta.S.C& Kapoor, V.K, "Fundamentals of Mathematical Statistics", Sultan Chand & sons, New Delhi 2011.

UNIT – I	Chapter – 2	Sections 2.2 to 2.5 of [1]
UNIT – II	Chapters – 6& 8	Sections 6.3.2 to 6.3.3& 8.3.1 to 8.3.2 of [1]
UNIT – III	Chapters – 7 & 5	Sections 7.2, 7.4, 7.5 & 5.4.1 to 5.4.3 of [1]
UNIT – IV	Chapters – 2& 3	Sections 2.3 to 2.5.2, 2.6 to 2.9.1 & 3.3 – 3.5, 3.7 of [2]

REFERENCE(S):

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation”, New Age International Private Limited, 1999.
2. C.E. Froberg, “Introduction to Numerical Analysis”, II Edn., Addison Wesley, 1979.
3. P. Kandasamy, K.Thilagavathy, Calculus of Finite Differences and Numerical Analysis (Allied Mathematics), S.Chand&Co.Ltd, New Delhi.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22UMA1AC1	NUMERICAL METHODS AND STATISTICS					5	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 (✓) = 36					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		

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
28	2	2	2	28	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global,

Computer Application

(For the candidates admitted from the academic year 2022 - 2023 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - II – OPERATIONS RESEARCH

Course Code: **22UMA2AC2**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To study the methods used to solve assignment problems and transportation problems.
- To train the students in network problems

COURSE OUTCOMES

1. Recognize and relate LPP and solving LPP using graphical method.
2. Compute Simplex Algorithm, Two Phase Method and Big-M Method of LPP.
3. Explain Transportation problem and Evaluate its initial basic feasible solution.
4. Discuss and solve assignment problem using Hungarian algorithm.
5. Describe and Construct Network and compute PERT and CPM.

UNIT – I

Linear Programming Problem: Introduction - Graphical Solution Method–General Linear Programming Problem - Canonical and Standard forms of LPP.

UNIT - II

Linear Programming Problem (Continued): Introduction -Simplex Method for $< , = , >$ constraints–Big-M Method.

UNIT - III

Transportation Problem: Introduction – LP formulation of the Transportation Problem – Finding an Initial Basic Feasible Solution- Transportation Algorithm (Modi Method) – Unbalanced Transportation Problem.

UNIT – IV

Assignment Algorithm: Introduction-Mathematical Formulation of the Problem–Solution Methods of Assignment Problem – Special Cases in Assignment Problems- Travelling salesman Problem.

UNIT – V

Networks: Introduction– Network (Basic Components)–Logical Sequencing– Rules of Networking Construction – Concurrent Activities-CPM computation- PERT computation.

TEXT BOOK:

1. KantiSwarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand &Co.Ltd.2012

UNIT – I	Chapter – 3	Sections 3.1 to 3.5
UNIT – II	Chapter – 4	Sections 4.1, 4.3 &4.4
UNIT – III	Chapter – 10	Sections 10.1, 10.2, 10.9 to 10.13 &10.15
UNIT – IV	Chapter – 11	Sections 11.1 to 11.4& 11.7
UNIT – V	Chapter – 25	Sections 25.1 to 25.7.

REFERENCE(S):

1. PremKumar,Gupta and D.S. Hira, “Operations Research”, An Introduction, S. Chand and Co., Ltd. New Delhi,
2. Hamdy.A.Taha, “Operations Research”, Seventh Edition, McMillan Publishing Company, New Delhi, 1982.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22UMA2AC2	OPERATIONS RESEARCH					5	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 (✓) = 32						Relationship: MODERATE					

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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	0	0	0	24	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global,

B.Sc. Computer Science & B.Sc. Information Technology

(For the candidates admitted from the academic year 2022 - 2023 onwards)

ALLIED MATHEMATICS**ALLIED COURSE -I -NUMERICAL METHODS**Course Code: **22UMA1AC1:1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

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

Course Outcomes:

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

1. Compute the Solution of Algebraic and Transcendental equation using Bisection, Method of false position and Newton- Raphson Method.
2. Find the solution of linear system of equation by Gaussian Elimination, Gauss Jacobi, and Gauss Seidel Methods
3. Solve Interpolation of Finite differences – Newton’s Forward, Central and Backward differences
4. Obtain the Numerical differentiation and integration.
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 Raphson Method,.

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 and Backward Differences to compute derivatives -Numerical Integration using Trapezoidal rule - Simpson’s one-third and three-eight rule.

UNIT – V

Numerical Solution of ODE: Solution by Taylor Series Method – Euler Method – Runge Kutta 2nd and 4th order Methods.

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	Sections 9.1 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.
3. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt.Limited, 4th Edition, 2009.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22UMA1AC1:1	NUMERICAL METHODS					5	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 (✓) = 36						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
22	0	0	0	22	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

B.Sc. Computer Science& B.Sc. Information Technology

(For the candidates admitted from the academic year 2022 - 2023 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - I –STATISTICAL METHODS

Course Code: **22UMA2AC2:1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To develop the basic concepts of statistics.
- To apply the basic ideas of statistical datas.

COURSE OUTCOMES:

1. Calculate Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean.
2. Illustrate the dispersion, Skewness and Kurtosis.
3. Understand the concept of Correlation & Gain the Knowledge of Regression
4. To be able to deduce statistical inference of a data through sampling techniques Understand Student's t-test of Difference of means
5. Student learns how to Test of significance for large samples & Chi-Square variate.

UNIT – I

Statistical data: Introduction –Formation of frequency distribution- Graphic representation of a frequency distribution - various 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– Skewness and kurtosis (Simple Problems only).

UNIT –III

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

Regression: Introduction – Linear regression – curvilinear regression – regression curves

UNIT –IV

Test of significance for Small samples: Parameter and statistics – Statistical hypothesis - Students t - test and its properties – independent and paired t - tests – simple problems – Snedcer's F- test and its properties – simple problems

UNIT – IV

Test of significance for large samples: One tailed and two tailed tests – Significance difference between one and two proportion based tests - Significance difference between one and two mean based tests – simple problems.

Chi-Square distribution: Properties – Uses– Goodness of fit – Conditions for the validity – Independence of attributes

TEXT BOOK:

1. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics – Sultan Chand & Sons, 2011.
2. T. Veerarajan, Probability, Statistics and Random processes, 3rd Edition: 2012, Tata McGraw Hill Education Private Limited, New Delhi

UNIT – I	Chapter – 2	Sections 2.1 to 2.9 of [1]
UNIT – II	Chapter – 2	Sections 2.13, 2.14, 2.16, 2.17 of [1]
UNIT – III	Chapter – 10 & 11	Sections 10.1 to 10.4, 10.7 & 11.1 to 11.4 of [1]
UNIT – IV	Chapter – 8	Page no. 419 to 421, 447 to 464 [2]
UNIT – V	Chapter – 8	Page no. 422 to 442 & 466 to 482 [2]

REFERENCES:

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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22UMA2AC2:1	STATISTICAL METHODS					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: 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

Total	Number of Topics				Category Based on %
Number of Topics	Local	Regional	National	Global	THRC Allied Mathematics 2022
	40	6	6	6	

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

B.Sc. Computer Science & B.Sc. Information Technology

(For the candidates admitted from the academic year 2022 - 2023 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - II – OPERATIONS RESEARCH

Course Code: **22UMA2AC3:1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To study the methods used to solve assignment problems and transportation problems.
- To train the students in network problems

COURSE OUTCOMES

1. Recognize and relate LPP and solving LPP using graphical method.
2. Compute Simplex Algorithm, Two Phase Method and Big-M Method of LPP.
3. Explain Transportation problem and Evaluate its initial basic feasible solution.
4. Discuss and solve assignment problem using Hungarian algorithm.
5. Describe and Construct Network and compute PERT and CPM.

UNIT – I

Linear Programming Problem: Introduction - Graphical Solution Method– General Linear Programming Problem - Canonical and Standard forms of LPP.

UNIT - II

Linear Programming Problem (Continued): Introduction -Simplex Method for $<$, $=$, $>$ constraints–Big-M Method.

UNIT - III

Transportation Problem: Introduction – LP formulation of the Transportation Problem – Finding an Initial Basic Feasible Solution- Transportation Algorithm (Modi Method) – Unbalanced Transportation Problem.

UNIT – IV

Assignment Algorithm: Introduction-Mathematical Formulation of the Problem–Solution Methods of Assignment Problem – Special Cases in Assignment Problems- Travelling salesman Problem.

UNIT – V

Networks: Introduction– Network (Basic Components)–Logical Sequencing– Rules of Networking Construction – Concurrent Activities-CPM computation- PERT computation.

TEXT BOOK:

1. Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand & Co.Ltd.2012
UNIT – I Chapter – 3 Sections 3.1 to 3.5

UNIT – II	Chapter – 4	Sections 4.1, 4.3 &4.4
UNIT – III	Chapter – 10	Sections 10.1, 10.2, 10.9 to 10.13 &10.15
UNIT – IV	Chapter – 11	Sections 11.1 to 11.4& 11.7
UNIT – V	Chapter – 25	Sections 25.1 to 25.7.

REFERENCE(S):

1. PremKumar,Gupta and D.S. Hira, “Operations Research”, An Introduction, S. Chand and Co., Ltd. New Delhi,
2. Hamdy.A.Taha, “Operations Research”, Seventh Edition, McMillan Publishing Company, New Delhi, 1982.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
II	22UMA2AC3:1	OPERATIONS RESEARCH					5	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 (✓) = 32						Relationship: MODERATE						

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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	0	0	0	24	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global,

B.Sc., PHYSICS

(For the candidates admitted from the academic year 2022-2023 onwards)

ALLIED MATHEMATICS**ALLIED COURSE - I –ALGEBRA AND CALCULUS**Course Code: **22UMA1AC1:2**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits:3

External Marks: 75

OBJECTIVES:

- To train the students to solve the problems in Theory of Equations.
- To learn the basic concepts in the integration.

COURSE OUTCOMES

1. Apply domain knowledge for Relation between the coefficients and the roots of an algebraic equation with illustrate the examples.
2. Determine the concepts of Eigen values and Eigen vectors .
3. To find maxima and minima,critical points and inflection points of functions.
4. To gain the Knowledge of various types of Integration.
5. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.

UNIT – I

Theory of Equations: Relation between roots & coefficients–Transformations of Equations – Diminishing,Increasing & Multiplying the roots by a constant- Rolle’s Theorem-Descarte’s rule of Signs (statement only) – **Simple problems**

UNIT – II

Matrices :Singular matrices – Inverse of a non-singular matrix using adjoint method- Rank of a Matrix – Consistency – Characteristic equation - Eigen values - Eigen vectors – Cayley Hamilton’s Theorem (proof not needed)– **Simple applications only**

UNIT – III

Differentiation: Maxima & Minima – Concavity -Convexity – Points of inflexion - Partial differentiation– Euler’s Theorem- Total differential coefficients (proof not needed) – **Simple problems only.**

UNIT –IV

Integration: Evaluation of integrals of types 1. $\int \frac{px+q}{ax^2+bx+c} dx$ -2. $\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$ 3. $\int \frac{dx}{a+bsinx}$ - 4. $\int \frac{dx}{a+bcosx}$ - Evaluation using Integration by parts .

UNIT – V

Differential Equations: Variables Separables – Linear equations– Second order of types $(aD^2 + bD + c)y = F(x)$ where a,b,c are constants and F(x) is one of the following types (i) e^{Kx} - (ii) $\sin(kx)$ or $\cos(kx)$ - (iii) x^n , n being an integer

TEXT BOOK(S):

1. T.K. Manickavasagam Pillai & Others, Algebra, VolII, S.V Publications, 2004 (Unit I)
2. T.K. Manickavasagam Pillai & Others, Algebra, VolIII, S.V Publications, Pvt.Ltd 2011. (Unit II)

3. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. I, S. Viswanathan Pvt Limited, 2010. (Units III)
4. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. II, S. Viswanathan Pvt Limited, 2011. (Units IV)
5. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt Limited, 2008 (Units V)

UNIT – I	Chapter – 6	Sections 11, 15, 17, 18, 24, 25 of [1]
UNIT – II	Chapter – 2	Sections 1 to 16 of [2]
UNIT – III	Chapters – 5 & 8	Sections 1, 2 & 1.1 to 1.6 of [3]
UNIT – IV	Chapter – 1	Sections 7, 8, 9, 11 of [4]
UNIT – V	Chapter – 1 & 2	Sections 2.1, 2.4 & 1 to 3 of [5]

REFERENCE:

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.
2. S. Rethina Kumar, “Algebra and Calculus”, Sai Publication – 2015.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22UMA1AC1:2	ALGEBRA AND CALCULUS					5	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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
31	3	3	3	31	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

B.Sc., PHYSICS

(For the candidates admitted from the academic year 2022-23 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - II - ANALYTICAL GEOMETRY (3D), TRIGONOMETRY AND FOURIER SERIES

Course Code: **22UMA2AC2:2**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To learn the basic needs Trigonometry.
- To learn the basic ideas of Fourier Series.

COURSE OUTCOMES

1. Describe the equation of a straight line passing through two given points and shortest distance between two skew lines.
2. Finding centre, radius and length of the tangent plan to a sphere.
3. Expansion of $\sin nx$, $\cos nx$, $\tan nx$ and powers of \sin and \cos in terms of functions of multiples of θ
4. Define and illustrate the concept of hyperbolic functions
5. Find Odd and Even function, Half range Fourier series.

UNIT – I

Equation of a straight line passing through two given points - Condition for a line to be parallel to a plane - Coplanar lines- Shortest distance between two given lines– **Simple problems**.

UNIT – II

Equation of a sphere- **Finding centre and radius**- Length of the tangent to a sphere- Plane section of a sphere – Intersection of two spheres.

UNIT – III

Expansion of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ (n being a positive integer)- Expansion of $\sin^n \theta$, $\cos^n \theta$, $\sin^n \theta \cos^m \theta$ in a series of sines & cosines of multiples of θ (θ - given in radians)- Expansion of $\sin \theta$, $\cos \theta$ and $\tan \theta$ in terms of powers of θ (only problems in all the above).

UNIT – IV

Euler's formula for $e^{i\theta}$ - Definition of Hyperbolic functions –Formulae involving Hyperbolic functions-Relation between Hyperbolic & circular functions– Expansion of $\sin hx$, $\cosh x$, $\tan hx$ in powers of x

UNIT – V

Definition of Fourier Series– Finding Fourier Coefficients for a given periodic function with period 2π - Use of Odd & Even functions in evaluating Fourier Coefficients

TEXT BOOK(S):

1. T.K.ManickavasagomPillai, T.Natarajan, “Analytical Geometry (3D)” Part-II, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011.
2. S. Narayanan, T.K. ManichavasagomPillai, “ Trigonometry”, S. Viswanathan (Printers & Publishers, Pvt Limited, 2011.
3. S.Narayanan, T.K. ManichavasagomPillai, “Calculus” Volume – III, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011.

UNIT – I	Chapter – 3	Sections 4, 5, 7& 8 of [1]
UNIT – II	Chapter –4	Sections 2 to 5 of [1]
UNIT – III	Chapter–3	of [2]
UNIT – IV	Chapter –4	Sections 1,2 (2.1, 2.2)of[2]
UNIT – V	Chapter – 6	Sections 1 to 3 of [3]

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
II	22UMA2AC2:2	ANALYTICAL GEOMETRY (3D), TRIGONOMETRY AND FOURIER SERIES	5	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(✓) = 35 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

Total Number of Topics	Number of Topics				THRC Allied Mathematics 2022
	Local	Regional	National	Global	Category Based on %
20	3	3	3	20	Regional

Green - Local, Pink - Regional, Blue - National, Brown – Global

B.Sc., PHYSICS

(For the candidates admitted from the academic year 2022-23 onwards)

ALLIED MATHEMATICS

ALLIED COURSE – III –ODE, PDE AND LAPLACE TRANSFORMS

Course Code: **22UMA2AC3:2**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To study the methods used to solve differential equations of first order and second order
- To get the knowledge about Laplace Transforms and Fourier series.

COURSE OUTCOMES

1. Equations solvable for dy/dx , x and y .
2. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.
3. Understand Laplace transforms and discuss the Properties of Laplace transforms.
4. Define and illustrate the inverse Laplace transforms.
5. Discuss the Application of Laplace transforms.

UNIT – I

Ordinary Differential Equations: First order higher degree equations- solvable for x , y , p - Clairaut's form.

UNIT – II

Partial Differential Equations: Formation of equations by elimination of arbitrary constants and function -Definition of general, particular and complete solutions- solving standard forms
 (i) $f(p,q) = 0$ (ii) $f(x,p,q) = 0$, $f(y,p,q) = 0$, $f(z, p,q)=0$
 - Lagrange's Differential equations $Pp+Qq = R$ - Charpit's Method.

UNIT –III

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

UNIT – IV

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

UNIT – V

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

TEXT BOOK:

1. S. Narayanan and T. K. Manicavachagam Pillai, Differential Equations and its Applications, S. Viswanathan Publishers Pvt. Ltd., 2011.

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

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22UMA2AC3:2	ODE, PDE AND LAPLACE TRANSFORMS					5	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 (✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	2	2	2	20	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

B.Sc., CHEMISTRY

(For the candidates admitted from the academic year 2022-2023 onwards)

ALLIED MATHEMATICS**ALLIED COURSE - I –ALGEBRA AND CALCULUS**Course Code: **22UMA3AC3:1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits:3

External Marks: 75

OBJECTIVES:

- To train the students to solve the problems in Theory of Equations.
- To learn the basic concepts in the integration.

COURSE OUTCOMES

1. Apply domain knowledge for Relation between the coefficients and the roots of an algebraic equation with illustrate the examples.
2. Determine the concepts of Eigen values and Eigen vectors .
3. To find maxima and minima,critical points and inflection points of functions.
4. To gain the Knowledge of various types of Integration.
5. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.

UNIT – I

Theory of Equations: Relation between roots & coefficients–Transformations of Equations – Diminishing,Increasing & Multiplying the roots by a constant- Rolle’s Theorem-Descarte’s rule of Signs (statement only) – **Simple problems**

UNIT – II

Matrices :Singular matrices – Inverse of a non-singular matrix using adjoint method- Rank of a Matrix – Consistency – Characteristic equation - Eigen values - Eigen vectors – Cayley Hamilton’s Theorem (proof not needed)– **Simple applications only**

UNIT – III

Differentiation: Maxima & Minima – Concavity -Convexity – Points of inflexion - Partial differentiation– Euler’s Theorem- Total differential coefficients (proof not needed) – **Simple problems only.**

UNIT –IV

Integration: Evaluation of integrals of types 1. $\int \frac{px+q}{ax^2+bx+c} dx$ -2. $\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$ 3. $\int \frac{dx}{a+bsinx}$ -
4. $\int \frac{dx}{a+bcosx}$ - Evaluation using Integration by parts .

UNIT – V

Differential Equations: Variables Separables – Linear equations– Second order of types $(aD^2 + bD + c)y = F(x)$ where a,b,c are constants and F(x) is one of the following types (i) e^{Kx} - (ii) $\sin(kx)$ or $\cos(kx)$ - (iii) x^n , n being an integer

TEXT BOOK(S):

1. T.K. Manickavasagam Pillai & Others, Algebra, Vol I, S.V Publications , 2004 (Unit I)
2. T.K. Manickavasagam Pillai & Others, Algebra, Vol II, S.V Publications, Pvt.Ltd 2011. (Unit II)

3. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. I, S. Viswanathan Pvt Limited, 2010. (Units III)
4. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. II, S. Viswanathan Pvt Limited, 2011. (Units IV)
5. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt Limited, 2008 (Units V)

UNIT – I	Chapter – 6	Sections 11, 15, 17, 18, 24, 25 of [1]
UNIT – II	Chapter – 2	Sections 1 to 16 of [2]
UNIT – III	Chapters – 5 & 8	Sections 1, 2 & 1.1 to 1.6 of [3]
UNIT – IV	Chapter – 1	Sections 7, 8, 9, 11 of [4]
UNIT – V	Chapter – 1 & 2	Sections 2.1, 2.4 & 1 to 3 of [5]

REFERENCE:

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.
2. S. Rethina Kumar, “Algebra and Calculus”, Sai Publication – 2015.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22UMA3AC3:1	ALGEBRA AND CALCULUS					5	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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
31	3	3	3	31	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

B.Sc., CHEMISTRY

(For the candidates admitted from the academic year 2022-23 onwards)

ALLIED MATHEMATICS**ALLIED COURSE - II - ANALYTICAL GEOMETRY (3D), TRIGONOMETRY AND FOURIER SERIES**Course Code: **22UMA4AC4:1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To learn the basic needs Trigonometry.
- To learn the basic ideas of Fourier Series.

COURSE OUTCOMES

1. Describe the equation of a straight line passing through two given points and shortest distance between two skew lines.
2. Finding centre, radius and length of the tangent plan to a sphere.
3. Expansion of $\sin nx$, $\cos nx$, $\tan nx$ and powers of \sin and \cos in terms of functions of multiples of θ
4. Define and illustrate the concept of hyperbolic functions
5. Find Odd and Even function, Half range Fourier series.

UNIT – I

Equation of a straight line passing through two given points - Condition for a line to be parallel to a plane - Coplanar lines- Shortest distance between two given lines– **Simple problems**.

UNIT – II

Equation of a sphere- **Finding centre and radius**- Length of the tangent to a sphere- Plane section of a sphere – Intersection of two spheres.

UNIT – III

Expansion of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ (n being a positive integer)- Expansion of $\sin^n\theta$, $\cos^n\theta$, $\sin^n\theta\cos^m\theta$ in a series of sines & cosines of multiples of θ (θ - given in radians)- Expansion of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of powers of θ (only problems in all the above).

UNIT – IV

Euler's formula for $e^{i\theta}$ - Definition of Hyperbolic functions –Formulae involving Hyperbolic functions-Relation between Hyperbolic & circular functions– Expansion of $\sin hx$, $\cosh x$, $\tan hx$ in powers of x

UNIT – V

Definition of Fourier Series– Finding Fourier Coefficients for a given periodic function with period 2π - **Use of Odd & Even functions** in evaluating Fourier Coefficients

TEXT BOOK(S):

1. T.K.ManickavasagamPillai, T.Natarajan, “Analytical Geometry (3D)” Part-II, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011.
2. S. Narayanan, T.K. ManichavasagamPillai, “ Trigonometry”, S. Viswanathan (Printers & Publishers, Pvt Limited, 2011.
3. S.Narayanan, T.K. ManichavasagamPillai, “Calculus” Volume – III, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011.

UNIT – I	Chapter – 3	Sections 4, 5, 7& 8 of [1]
UNIT – II	Chapter –4	Sections 2 to 5 of [1]
UNIT – III	Chapter–3	of [2]
UNIT – IV	Chapter –4	Sections 1,2 (2.1, 2.2)of [2]
UNIT – V	Chapter – 6	Sections 1 to 3 of [3]

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
II	22UMA4AC4:1	ANALYTICAL GEOMETRY (3D), TRIGONOMETRY AND FOURIER SERIES					5	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(✓) = 35 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	3	3	3	20	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

B.Sc., CHEMISTRY

(For the candidates admitted from the academic year 2022-23 onwards)

ALLIED MATHEMATICS

ALLIED COURSE – III –ODE, PDE AND LAPLACE TRANSFORMS

Course Code: **22UMA4AC5:1**

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 3

External Marks: 75

OBJECTIVES:

- To study the methods used to solve differential equations of first order and second order
- To get the knowledge about Laplace Transforms and Fourier series.

COURSE OUTCOMES

1. Equations solvable for dy/dx , x and y .
2. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.
3. Understand Laplace transforms and discuss the Properties of Laplace transforms.
4. Define and illustrate the inverse Laplace transforms.
5. Discuss the Application of Laplace transforms.

UNIT – I

Ordinary Differential Equations: First order higher degree equations- solvable for x , y , p - Clairaut's form.

UNIT – II

Partial Differential Equations: Formation of equations by elimination of arbitrary constants and function -Definition of general, particular and complete solutions- solving standard forms
 (i) $f(p,q) = 0$ (ii) $f(x,p,q) = 0$, $f(y,p,q) = 0$, $f(z, p,q)=0$
 - Lagrange's Differential equations $Pp+Qq = R$ - Charpit's Method.

UNIT –III

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

UNIT – IV

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

UNIT – V

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

TEXT BOOK:

1. S. Narayanan and T. K. Manicavachagam Pillai, Differential Equations and its Applications, S. Viswanathan Publishers Pvt. Ltd., 2011.

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

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22UMA4AC5:1	ODE, PDE AND LAPLACE TRANSFORMS					5	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 (✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	2	2	2	20	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

M.Sc MATHEMATICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2022 – 2023 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)



THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B⁺⁺)

(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 postgraduate will be able to

1. Gain advanced knowledge resulting in entrepreneurship; innovation and newer opportunities for being employable in public and private sectors, research and development organizations
2. Apply enhanced new techniques and adopt new technologies needed in the respective disciplines
3. Appreciate the diversity of behaviour in professional practice and act in accordance with the core values of chosen profession
4. Demonstrate the knowledge, values and skills to be critical consumer of research practice and possess investigative skills to evaluate the practice
5. Engage in lifelong learning process, have the ability to communicate the findings of Languages/ Commerce/ Management Studies/ Social Work/ Computing Sciences/Physical Sciences/Biological Sciences/Life Sciences with the current knowledge

Program Specific Outcomes(PSOs)

1. Understanding of the fundamental axioms in Mathematics and capability of developing ideas based on them.
2. Ability to build and administrate the Mathematical models to solve real time problems.
3. Aptitude and Reasoning skills that will help to take up research in pure and applied mathematics.
4. Employability Skills that will enable the students to explore career in Teaching and Research in Mathematics.
5. Recognize the need to engage lifelong learning of Mathematics through continuing education and Research.

Thanthai Hans Roever College (Autonomous)Elambalur, Perambalur – 621 220**M.Sc., MATHEMATICS****CHIOCE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM****FRAMEWORK (CBCS – LOCF)**

(For the candidates admitted from the academic year 2022 – 2023 onwards)

Semester	Name of the Courses	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
I	CC – I	22PMA1CC1	Algebra	6	5	3	25	75	100
	CC – II	22PMA1CC2	Real Analysis	6	5	3	25	75	100
	CC – III	22PMA1CC3	Ordinary Differential Equations	6	5	3	25	75	100
	CCC – I	22PMA1CCC1:1 22PMA1CCC1:2	Classical Dynamics Fluid Dynamics	6	5	3	25	75	100
	EC – I	22PMA1EC1:1 22PMA1EC1:2	Advanced Graph Theory Elements of Stochastic Processes	6	4	3	25	75	100
	VAC – I	22PVAMA1:1 22PVAMA1:2	MS – OFFICE Introduction to MATLAB	-	2*				100*
			Total	30	24	-	-	-	500
II	CC – IV	22PMA2CC4	Linear Algebra	6	5	3	25	75	100
	CC – V	22PMA2CC5	Complex Analysis	6	5	3	25	75	100
	CC – VI	22PMA2CC6	Programming in C++	5	4	3	25	75	100
	CCC – II	22PMA2CCC2:1 22PMA2CCC2:2	Partial Differential Equations Probability Theory	5	4	3	25	75	100
	EC – II	22PMA2EC2:1 22PMA2EC2:2	Fuzzy sets and their Applications Numerical Analysis	5	4	3	25	75	100
	NME – I	22PMA2NME1:1 22PMA2NME1:2	Statistics Discrete Mathematics	3	2	3	25	75	100
	Extra Credit Course	22PMA2OC	SWAYAM / NPTEL Online Courses		2**				
			Total	30	24	-	-	-	600
III	CC – VII	22PMA3CC7	Topology	6	5	3	25	75	100
	CC – VIII	22PMA3CC8	Calculus of variations, Integral Equations and Transforms	6	5	3	25	75	100
	CP – I	22PMA3CP1	Programming in C++ (Practical)	6	3	3	40	60	100
	CCC – III	22PMA3CCC3:1 22PMA3CCC3:2	Measure Theory and Integration Methods of Mathematical Physics	6	4	3	25	75	100
	EC – III	22PMA3EC3:1 22PMA3EC3:2	Applied Statistics Financial Mathematics	6	4	3	25	75	100
	VAC – II	22PVAMA2:1 22PVAMA2:2	Vedic Mathematics Introduction to LATEX		2*				100*
			Total	30	21	-	-	-	500

4	CC – IX	22PMA4CC9	Functional Analysis	6	5	3	25	75	100
4	CC – X	22PMA4CC10	Differential Geometry	6	5	3	25	75	100
4	E/ IBC	22PMA4IBC	Optimization Techniques	6	4	3	40	60	100
4	NME – II	22PMA4NME2:1	Analytical Reasoning & Mental Ability Sage Math	3	2	3	25	75	100
		22PMA4NME2:2							
4		22PMA4PW	Project	9	5	-	-	-	100
			Total	30	21	-	-	-	500
			Grand Total	120	90	-	-	-	2100

SUMMARY OF CURRICULUM STRUCTURE OF PG PROGRAMMES

Sl. No.	Types of the Courses	No. of Courses	No. of Credits	Marks
1.	Core Courses	10	49	1000
2.	Core Choice Courses	3	13	300
3.	Core Practical	1	3	100
4.	Elective Courses	3	12	300
5.	Entrepreneurship/Industry Based Course	1	4	100
6.	Project	1	5	100
7.	Non-Major Elective Courses	2	4	200
	Total	21	90	2100
	Value Added Courses*	2*	4*	200*

* The value added courses credit will not be included in the total CGPA. These courses are extra-credit courses.

Instruction hours for these courses are 30 hours.

List of Core Choice Courses

Core Choice	Course Code	Title of the Course
Core Choice	22PMA1CCC1:1	Classical Dynamics
	22PMA1CCC1:2	Fluid Dynamics
Core Choice	22PMA2CCC2:1	Partial Differential Equations
	22PMA2CCC2:2	Probability Theory
Core Choice	22PMA3CCC3:1	Measure Theory and Integration
	22PMA3CCC3:2	Methods of Mathematical Physics

List of Elective Courses

Elective	Course Code	Title of the Course
Elective – 1	22PMA2EC1:1 22PMA2EC1:2	1. Advanced Graph theory 2. Elements of Stochastic Processes
Elective –2	22PMA2EC2:1 22PMA2EC2:2	1. Fuzzy sets and their Applications 2. Numerical Analysis
Elective – 3	22PMA3EC3:1 22PMA3EC3:2	1. Applied Statistics 2. Financial Mathematics

List of Elective Courses

Value Added Courses	Course Code	Title of the Course
VAC – I	22PVAMA1:1 22PVAMA1:2	MS – Office Introduction to MATLAB
VAC – II	22PVAMA2:1 22PVAMA2:2	Vedic Mathematics Introduction to LATEX

List of Non - Major Elective Courses

Value Added Courses	Course Code	Title of the Course
NME – I	22PMA2NME1:1 22PMA2NME1:2	Statistics Discrete Mathematics
NME – II	22PMA4NME2:1 22PMA4NME2:2	Analytical Reasoning & Mental Ability Sage Math

1. Theory - Internal 25 marks External 75 marks.
2. Practical - Internal 40 marks External 60 marks.
3. Separate passing minimum is prescribed for Internal and External
 - a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
 - b) The passing minimum for Semester Examinations shall be 40% out of 75Marks (i.e. 30 mark).
 - c) The passing minimum not less than 50% in the aggregate.

Question Paper Pattern

Mathematics Programme		
Maximum Marks : 75		Duration: 3 Hours
Section - A	Part – A (5 Multiple Choice Questions) One question from each unit	5 x 1 = 5 Marks
	Part – B (5 fill in the Blanks) One question from each unit	5 x 1 = 5 Marks
	Part – C (5 short answer questions) One question from each unit	5 x 2 = 10 Marks
Section - B Paragraph	5 Questions (Internal Choice) One set of questions from each unit	5 x 5 = 25 Marks
Section - C Essay Type	3 Questions (Answer any 3 out of 5 Questions) One question from each unit	3 x 10 = 30 Marks
Total		75 Marks

MODEL QUESTION PAPER:

M.Sc., SEMESTER EXAMINATION

Time: 3 Hours

Maximum Marks – 75

SECTION – A

Answer **ALL** of the Following

Part – A & Part – B (10 x 1 = 10)

Part – C (5 x 2 = 10)

SECTION – B

Answer **ALL** of the Following

(5 x 5 = 25 Marks)

SECTION – C

Answer any **THREE** of the Following

(3 x 10 = 30 Marks)

SEMESTER – I

Course Code: 22PMA1CC1

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE –I – ALGEBRA**OBJECTIVES:**

- To provide foundation in group.
- To enhance the power of ideas for solving the problems in Algebra

COURSE OUTCOMES:

At the end of the course, students will be able

1. To find the number of Sylow subgroups.
2. To find the number of non-isomorphic abelian groups.
3. Discuss the algebraic concepts of splitting field and its illustrations.
4. To Gain the knowledge Galois Theory.
5. Describe some of the canonical forms of linear transformations such as triangular, Hermitian, Unitary and normal transformations.

UNIT – I

SYLOW'S THEOREM: Cayley's Theorem-Another Counting Principle – 1st, 2nd & 3rd parts of Sylow's Theorems – double coset – The normalizer of a group.

UNIT – II

FINITE ABELIAN GROUPS: External and Internal direct products – Structure theorem for finite abelian groups – Non isomorphic abelian groups – Polynomial rings.

UNIT – III

SPLITTING FIELD: Polynomials over rational fields – The Eisenstein criterion – Extension fields – Roots of polynomials – Splitting fields.

UNIT – IV

GALOIS THEORY: More about roots – Simple extension – Separable extension – Fixed fields – Symmetric rational functions – Normal extension – Galois group – Fundamental theorem of Galois Theory.

UNIT – V

LINEAR TRANSFORMATIONS: Canonical Forms-Triangular Form – Hermitian Transformation- Unitary and Normal Transformation.

TEXT BOOK:

1. I.N.Herstein, Topics in Algebra, Second Edition, John Wiley & Sons New York, 2014.

UNIT – I	Chapter – 2	Sections 2.9, 2.11 & 2.12
UNIT – II	Chapters – 2 & 3	Sections 2.13, 2.14 & 3.9
UNIT – III	Chapters – 3 & 5	Sections 3.10 & 5.1, 5.3
UNIT – IV	Chapter – 5	Sections 5.5 & 5.6
UNIT – V	Chapter – 6	Sections 6.4 & 6.10

REFERENCE(S):

1. Serge Lang, Algebra, Third Edition, Springer Graduate texts in Mathematics, New York, 2002.
2. M.Artin, "Algebra" Prentice-Hall of India Pvt. Ltd. 1991.
3. N.S.Gopala Krishnan, University Algebra, Second Edition, John Wiley & Sons (Asia) Pvt. Ltd, 1986.

Web Link:

1. <https://dibene.files.wordpress.com/2011/02/serge-lang-linear-algebra.pdf>
2. <http://home.ustc.edu.cn/~liweiyu/documents/Algebra,%20Second%20Edition,%20Michael%20Artin.pdf>
3. <https://www.scribd.com/document/323600544/University-Algebra>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22PMA1CC1	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(✓) = 38						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	National

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PMA1CC2

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE –II– REAL ANALYSIS**OBJECTIVES:**

- Aim of the course is to enable the students to learn the basic concepts of real analysis.
- To understand a thorough knowledge of the various aspects of Real line and Sequence and series which is imperative for any advanced Learning in Pure Mathematics.

COURSE OUTCOMES:

On successful completion of the course, the students will understand the following:

1. Explain Sequences, Limits and Tests of convergence and Rearrangements.
2. Derive the existence of the Riemann - Stieltjes integral.
3. Explain Uniform convergence of continuity, integration and differentiation for sequences and series of functions.
4. Study the concept of function of several variables.
5. Describe about the Derivatives of higher order and differentiation of integrals.

UNIT – I

REAL NUMBER SYSTEM AND ITS ORDER COMPLETENESS, SEQUENCES AND SERIES OF REAL NUMBERS: Sequences – Convergence – Subsequences–Cauchy sequences –Upper and Lower Limits– Some special sequences– The Root and ratio tests–Tests of convergence–Absolute convergence–Addition and Multiplication of series – Rearrangements.

UNIT – II

RIEMANN – STIELTJES INTEGRAL: Definition and Existence of the integral – Properties of the integrals– Integration and Differentiation – Integration of vector valued functions –Rectifiable curves.

UNIT – III

SEQUENCES AND SERIES OF FUNCTIONS: Uniform convergence– Uniform and continuity - Power series –Weierstrass approximation theorem –Equicontinuity–Arzela-Ascoli theorem.

UNIT – IV

FUNCTIONS OF SEVERAL VARIABLES:Linear transformation – Differentiation – The contraction principle -The inverse function theorem – The implicit function theorem.

UNIT – V

The Rank theorem -Determinants – Derivatives of higher order –Differentiation of integrals.

TEXT BOOK:

1. Walter Rudin, Principles of Mathematical Analysis, Tata McGraw- Hill, New York, 1988.

UNIT – I Chapter – 3 Sections 3.1 to 3.20, 3.33, 3.45, 3.47 to 3.55

UNIT – II Chapter– 6 Sections 6.1 to 6.27

UNIT – III Chapters – 7 & 8 Sections 7.1 to 7.9, 7.26 to 7.33 & 8.1 to 8.5

UNIT – IV	Chapter – 9	Sections 9.1 to 9.29
UNIT – V	Chapter – 9	Sections 9.33 to 9.43

REFERENCE(S):

1. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
2. Kenneth A. Ross, Elementary Analysis: The theory of Calculus, Springer, New York, 2004.
3. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing co. Pvt. Ltd., New Delhi 1970.

Web Link:

1. <https://www.pdfdrive.com/elementary-analysis-the-theory-of-calculus-e186475584.html>
2. <https://www.pdfdrive.com/methods-of-real-analysisrichard-r-goldberg-e52359301.html>
3. <https://www.pdfdrive.com/principles-of-mathematical-analysis-e176194901.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22PMA1CC2	REAL 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(✓) = 39 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
31	0	0	0	31	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – I

Course Code: 22PMA1CC3

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE –III – ORDINARY DIFFERENTIAL EQUATIONS

OBJECTIVES:

- To give an in-depth knowledge of solving differential equations that we encounter frequently in various walks of life.
- To introduce existence and uniqueness theorem in differential equations.

COURSE OUTCOMES:

On successful completion of this course the learner will be equipped to

1. Solve Second order linear differential equations.
2. Discuss about the n^{th} order differentialequations.
3. Evaluate differential equations with variablecoefficients.
4. Model problems in differential equations with regular singularpoints.
5. Apply ODE problems for real timeapplications

UNIT – I

LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS:Introduction - Second order homogenous equations - Initial value problem for second order equations - Linear dependence and independence - A formula for Wronskian

UNIT – II

LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS (Cont'd.):The Non homogenous equations of order two - homogenous and Non homogenous equations of order n - Initial value problems for nth order equations- Annihilator method to solve non Homogenous equation.

UNIT – III

LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS: Initial value problem - Existence and uniqueness theorem - The Wronskian and linear independence- Reduction of the order of a homogenous equation - The non Homogenous equation- Homogenous equations with analytic coefficients - The Legendre equations

UNIT– IV

LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS:The Euler equations – Second order equations with regular singular points–Exceptional cases –The Bessel equation – The Bessel equation contd.

UNIT –V

EXISTENCE AND UNIQUENESS OF SOLUTIONS TO FIRST ORDER EQUATIONS:Equations with variable separated – Exact equations – The method of successive approximation – The Lipschitz Condition –Convergence of the successive approximation.

TEXTBOOK:

1. Earl A. Coddington, An Introduction to Ordinary Differential Equations – Prentice – Hall of India Private Limited, New Delhi 2008.

UNIT – I	Chapter – 2	Sections 1 to 5
UNIT – II	Chapter – 2	Sections 6 to 8, 10, 11
UNIT – III	Chapter – 3	Sections 2, 4 to 8
UNIT – IV	Chapter – 4	Sections 2, 3, 6 to 8
UNIT – V	Chapter – 5	Sections 2 to 6

REFERENCE:

- George F. Simmons, Differential Equations with Applications and Historical Notes, Tata McGraw-Hill Publishing Company Ltd., 1972.
- Williams E. Boyce and Richard C. DiPrima Elementary Differential Equations and Boundary Value Problems, 10th edition John Wiley and Sons, New York 2012
- M.D. Raisinghania, Advanced Differential Equations, S. Chand & Company Ltd., New Delhi 2012

Web Link:

- <https://www.pdfdrive.com/differential-equations-with-applications-and-historical-notes-third-edition-e47796807.html>
- <https://www.pdfdrive.com/elementary-differential-equations-and-boundary-value-problems-10th-edition-e50158362.html>
- <https://www.pdfdrive.com/ordinary-differential-equations-e31554207.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22PMA1CC3	ORDINARY DIFFERENTIAL EQUATIONS					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(✓) = 35						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PMA1CCC1:1

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE CHOICE COURSE –I– CLASSICAL DYNAMICS

OBJECTIVES:

- To give a detailed knowledge about the mechanical system of particles.
- To study the applications of Lagrange's equations and Hamilton's equations as well as theory of Hamilton-Jacobi Theory.

COURSE OUTCOMES:

On successful completion of the course, the students will understand the following:

1. Define mechanical system, Generalized Co-ordinates, Constraints and Virtual work.
2. Derivation of Lagrange's equation using elementary calculus as an alternative to the more advanced variational calculus derivation.
3. Write Hamilton's principle function and Jacobi equation, Separability.
4. The use of Hamilton-Jacobi in identifying conserved quantities for a mechanical system, even when the mechanical problem itself cannot be solved completely.
5. The use of analytical treatments in checking the numerical models in canonical transformations.

UNIT – I

INTRODUCTORY CONCEPTS: The mechanical system- Generalized Coordinates – Constraints – Virtual work – D'Alembert's principle – Energy and momentum – Equilibrium and Stability – Kinetic energy – Angular momentum.

UNIT – II

LAGRANGE'S EQUATIONS: Derivation of Lagrange's Equations for different conditions – Lagrange's Equations for simple systems – Integrals of the Motion – Routhian procedure – Natural system – Liouville's System.

UNIT – III

HAMILTON'S EQUATIONS: Stationary values – Hamilton's principle under different conditions – Hamilton's equations – The Legendre transformation – Modified Hamilton's principle – Principle of least action.

UNIT – IV

HAMILTON – JACOBI THEORY: Hamilton's Principal Function – Canonical Integral – Pfaffian differential form – The Hamilton-Jacobi equation – Jacobi's theorem – Modified Hamilton-Jacobi Equation

UNIT – V

CANONICAL TRANSFORMATIONS: Differential forms and generating functions – Some simple point and momentum transformations – Lagrange's and Poisson brackets.

TEXT BOOK:

1. Donald T. Greenwood, Classical Dynamics, PHI Pvt. Ltd., New Delhi-1985.

UNIT – I Chapter – 1 Sections 1.1 to 1.5

UNIT – II Chapter – 2 Sections 2.1 to 2.3

UNIT – III Chapter – 4 Sections 4.1 to 4.3

UNIT – IV Chapter – 5 Sections 5.1 to 5.3

UNIT – V Chapter – 6 Sections 6.1 to 6.3

REFERENCE(S):

1. H. Goldstein, Classical Mechanics, Second Edition, Narosa Publishing House, New Delhi.
2. Narayan Chandra Rana & Promod Sharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.

Web Link:

1. https://docs.google.com/file/d/0B5nvP_eIBYdjYWMwMDhhY2QtNzBmOS00NGM5LWE3NWQtZjFiN2NINTk3ZTNj/view?resourcekey=0-7x6BeBkfuEOr3-ARElwIBw
2. <https://books.google.com.bd/books?id=1kxkdWGa9-cC&printsec=copyright#v=onepage&q&f=false>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22PMA1CCC1:1	CLASSICAL DYNAMICS					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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
30	0	0	0	30	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PMA1CCC1:2
 Instruction Hours: 6
 Credits: 5

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

CORE CHOICE COURSE– I – FLUID DYNAMICS

OBJECTIVES:

- To establish an understanding of the fundamental concepts of fluid dynamics
- To make students understand the importance of fluid dynamics in diverse real life applications

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

1. Analyze fluid flow problems with the application of the momentum and energy equations
2. Understand modelling approximations in finding exact solutions.
3. Apply basic principles of multi-variable calculus, differential equations and complex variables to fluid dynamic problems.
4. Understood Laplace equation and Stoke's stream function.
5. State and Prove the Navier-Stokes equations and steady flow between parallel planes.

UNIT – I

INTRODUCTORY IDEAS: Quantities like velocity density pressure etc. – streamlines and pathlines- stream tubes and filaments – fluid body- Bernoulli's theorem - differentiation w.r.to time - equation of continuity – transport theorem - boundary conditions -rate of change of linear momentum.

UNIT – II

INVISCID THEORY: Euler's equation- conservative forces- Lagrangian form of the equation of motion - steady motion- energy equation- rate of change of circulation– Kelvin's theorem- vortex motion and its permanence.

UNIT – III

TWO DIMENSIONAL MOTION: Examples – stream function and velocity potential - complex potentials and flows – the singularities source - doublet and vortex - mixed flow method of images - circle theorem - flow past a circular cylinder with circulation– Blasius's theorem - lift force.

UNIT –IV

IRROTATIONAL MOTION IN THREE DIMENSIONS: Laplace equation – spherical harmonics – axially symmetric field – Stoke’s stream function – motion of a sphere – pressure distribution – drag force – axial distributions of sources and doublets – continuous distributions – flow near axis due to sources and doublets.

UNIT – V

VISCOUS THEORY: The Navier-Stokes equations - vorticity and circulation in a viscous fluid – some exact solutions – steady flow through an arbitrary cylinder with pressure – steady Couette flow between cylinders in relative motion – steady flow between parallel planes - Couette and plane Poiseuille flow.

REFERENCES:

1. L.M. Milne Thomson, Theoretical Hydrodynamics, Dover, 1996.
2. N. Curle and H.J. Davies, Modern Fluid Dynamics, D Van Nostrand Company Ltd., London, 1968.
3. S.W. Yuan, Foundations of Fluid Mechanics, Prentice- Hall of India, New Delhi, 1988.
4. F. Chorlton, Textbook of Fluid Dynamics, CBS Publishers, New Delhi, 2004.
5. A.J. Chorin and A. Marsden, A Mathematical Introduction to Fluid Dynamics, Springer-Verlag, New York, 1993.

Web Link

1. http://mdudde.net/pdf/study_material_DDE/M.Sc.MAthematics/Fluid_Dynamics_final.pdf
2. <https://www.pdfdrive.com/fluid-dynamics-part-1-classical-fluid-dynamics-d158427109.html>
3. <https://www.youtube.com/watch?v=9m5-kPzixfU>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22PMA1CCC1:2	FLUID DYNAMICS					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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
45	1	1	1	45	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PMA1EC1:1

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ELECTIVE COURSE –I–ADVANCED GRAPH THEORY

OBJECTIVES:

- To understand various parameters of Graph Theory with algorithms.
- To acquire sufficient knowledge and skill in the subject that will make them competent in various areas of mathematics.

COURSE OUTCOMES:

1. This helps students to understand various parameters of Graph Theory with algorithms.
2. Explain connectivity and edge-connectivity, 2-connected graphs and prove Menger's theorem.
3. Discuss Haval&Hakimi Algorithm
4. Define and illustrate the matching, system of distinct representatives and Marriage problem, covering.
5. Explain Independent sets and edge-colourings Prove Vizing's theorem.

UNIT –I

AN INTRODUCTION TO GRAPHS:Basic concepts –Isomorphism and Automorphism –The pigeonhole principle and Turan's theorem – Distance-Radius-Diameter and Girth – Subgraphs and Isometric subgraphs – Operations on Graphs –The Adjacency Matrices- Incidence and Path matrices – Introduction to Algorithms – Breadth first search Algorithm – Dijkstra's Algorithm – Ford's Algorithm.

UNIT – II

CONNECTIVITY: Connectivity and edge connectivity – 2 Connected graphs – Menger’s Theorem – Separable graphs– 1 Isomorphism and 2 Isomorphism.

UNIT – III

GRAPHIC SEQUENCES: Degree sequences – Graphic sequences – Wang and Kleitman’s Theorem – Haval&Hakimi Algorithm– Generalisation of Haval&Hakimi Algorithm

UNIT –IV

MATCHINGS: Matching – System of Distinct Representatives and Marriage Problem – Covering – Konig Egervary Theorem – 1 Factor Tutte’s Theorem – Stable Matchings – Application –The Hungarian Algorithm– Algorithm for Maximum Matching

UNIT – V

INDEPENDENCE: Independent Sets – Edge colourings – Application– Vizing’s Theorem – Vertex Colouring – Uniquely Colourable Graphs – Brook’s Bound and Improvements – Hajos Conjecture – Mycielski’s Construction – Line-distinguishing Colourings – Chromatic Polynomials –Sequential Colouring Algorithm.

TEXTBOOK:

1. M.Murugan, Graph Theory and Algorithms, Second Edition, Muthali Publishing House, Annanagar, Chennai, 2018.

UNIT – I	Chapter – 1	Sections 1.1, 1.4, 1.6, 1.8 to 1.12
UNIT – II	Chapter– 3	Sections 3.1 to 3.4
UNIT – III	Chapter–4	Sections 4.1 to 4.4
UNIT – IV	Chapter– 6	Sections 6.1 to 6.7
UNIT – V	Chapter – 7	Sections 7.1 to 7.6 & 7.8 to 7.13

REFERENCE(S):

1. J.A. Bondy and U.S.R. Murthy, Graph Theory with applications, Macmillan Co., London, 1976.
2. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Second Edition, Springer International Edition, New Delhi, 2008.

Web Link:

1. <https://www.pdfdrive.com/bondy-ja-murty-usr-graph-theory-with-applications-d187652858.html>
2. <https://www.pdfdrive.com/a-textbook-of-graph-theory-r-balakrishnan-k-ranganathanpdf-d18830765.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22PMA1EC1:1	ADVANCED GRAPH THEORY					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(✓) = 38 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
45	2	2	2	45	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PMA1EC1:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE – I –ELEMENTS OF STOCHASTIC PROCESSES

OBJECTIVES

- To enable every student to face the touch situation in the world.
- The study of stochastic process is precisely to give comparative knowledge to every student.

COURSEOUTCOMES:

1. Describe stability of a Markov Systemand limiting behavior.

2. Define Renewal process, Cumulative Process, Semi-Markov Process and Classify queuing processes.
3. Demonstrate queuing systems, Birth and Death queues with Finite and Infinite Capacity.
4. Illustrate M/G/1 and G/M/1 Queues
5. Study Brownian motion to create analytical skills and to think practical level in the real life situation so that the students can sharpen their knowledge better.

UNIT– I

Continuous Time Markov Chain -Examples -Transient Analysis -Occupancy Times-Limiting Behaviour.

UNIT –II

Renewal Process – Cumulative Process – Semi-Markov Process – Examples and Long term Analysis.

UNIT –III

Queuing Systems – Single-Station Queues– Birth and Death queues with Finite and Infinite Capacity

UNIT –IV

M/G/1Queues- G/M/1 Queues -Network of Queues

UNIT –V

Standard Brownian motion-Brownian motion and First Passage Times

TEXT BOOK:

1. V.G. Kulkarni, Introduction to Modelling and Analysis of Stochastic Systems, Second Edition, Springer (2011)

UNIT – I	Chapter – 4	Sections 4.1 to 4.6
UNIT – II	Chapter – 5	Sections 5.1 to 5.5
UNIT – III	Chapter – 6	Sections 6.1 to 6.4
UNIT – IV	Chapter – 6	Sections 6.5 to 6.7
UNIT – V	Chapter – 7	Sections 7.3 to 7.5

REFERENCE BOOKS:

1. J. Medhi, Stochastic Processes, NEW AGE (2009).
2. S. M. Ross, Stochastic Processes, Wiley Series in Probability and Statistics (1996).

Web Link:

1. <https://www.pdfdrive.com/stochastic-processes-sheldon-m-ross-e96204984.html>
2. <https://galton.uchicago.edu/~lalley/Courses/313/BrownianMotionCurrent.pdf>

Semester	Code	Title of the Course					Hours	Credits			
I	22PMA1EC1:2	ELEMENTS OF STOCHASTIC PROCESSES					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(✓) = 36						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
16	2	2	2	16	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PVAMA1:1
 Instruction Hours:
 Credits: 2

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

VALUE ADDED COURSE – I – MS - OFFICE

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 recipient.
- iv. Design a Company advertisement using header and footer.
- v. To wrapping text in news paper 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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
I	22VAM1:1	MS - OFFICE		2
Course	ProgrammeOutcomes(POs)		Programme Specific Outcomes(PSOs)	

Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO2	✓		✓		✓	✓		✓	✓	✓
CO3		✓	✓	✓			✓	✓		✓
CO4	✓	✓		✓	✓		✓		✓	✓
CO5		✓	✓		✓	✓	✓	✓	✓	
Number of Matches (✓)= 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
12	0	0	0	12	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22PVAMA1:2

Instruction Hours:

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

VALUE ADDED COURSE – I – INTRODUCTION TO MATLAB**COURSE OBJECTIVES**

- To learn features of MATLAB as a programming tool.
- To promote new teaching model that will help to develop programming skills and technique to solve mathematical problems.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Understand the main features of the MATLAB development environment.
2. Use the MATLAB GUI effectively.
3. Design simple algorithms to solve problems.
4. Write simple programs in MATLAB to solve scientific and mathematical problems.
5. Understand the concept of plot command and logarithmic axes.

UNIT – I

Starting with MATLAB -MATLAB windows – Working in command window - Arithmetic operations with scalars – Display Formats - Elementary math built-in functions – Defining scalar variables - Useful commands for managing variables - Script files.

UNIT – II

Creating Arrays – Variables - Transpose Operator - Array addressing - Adding elements to existing variables - Deleting elements - Built-in functions for handling arrays - strings and strings as variables.

UNIT – III

Mathematical Operations with Arrays: Addition and Subtraction – Multiplication – Division - Element-by-element operations - Built-in math functions - Built-in functions for analysing arrays - Generation of random numbers.

UNIT – IV

MATLAB workspace and the workspace window – Script file – Output commands – save and load commands – Importing and exporting commands.

UNIT – V

Plot command – fplot command - Plotting multiple graphs in the same plot – Formatting a plot – Plots with Logarithmic axes – Plots with error bars – Plots with special graphics.

REFERENCES:

1. Amos Gilat, MATLAB An Introduction with Applications, John Wiley & Sons, 2011.

- Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, A Guide to MATLAB - for Beginners and Experienced Users, 2nd Edition, Cambridge University Press, 2006.
- Stephen J. Chapman, Essentials of MATLAB Programming, Cengage Learning, 2009.

Web Link

- https://www.researchgate.net/profile/Hazim-Tahir/post/How-can-I-find-the-coefficient-for-fitting-a-curve-in-MATLAB/attachment/59d61dd179197b807797a400/AS%3A273591222898691%401442240638234/download/MATLAB_+An+Introduction+with+Ap+-+Amos+Gilat.pdf
- <http://www.uop.edu.pk/ocontents/A%20Guide%20to%20MATLAB.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22VAM1:2	INTRODUCTION TO MATLAB						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 (✓)= 33						Relationship: MODERATE					

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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
36	0	0	0	36	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – II

Course Code: 22PMA2CC4

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – IV – LINEAR ALGEBRA**OBJECTIVES:**

- To understand the various aspects of Linear Algebra.
- To develop the knowledge in problem solving skills.

COURSE OUTCOMES:

At the end of the course, students will be able

1. Understand the signification of linear transformations and linear Functional.
2. Define and illustrate the Polynomials and Inverse of an invertible matrix using determinants.
3. To describe a diagonalizable operator T and a triangulable operator.
4. Prove the sum Decompositions, Invariant Direct sums, Primary Decomposition theorem.
5. To find the minimal polynomials, Jordan forms and the rational forms of real matrices.

UNIT – I

LINEAR TRANSFORMATIONS: Linear Transformations – Isomorphism of vector spaces - Representation of linear transformations by Matrices– Linear functional- The double dual.

UNIT – II

ALGEBRA OF POLYNOMIALS: The algebra of polynomials –Lagrange Interpolation- Polynomialsideals – The prime factorization of a polynomial– Determinant functions.

UNIT – III

DETERMINANTS: Permutations and the Uniqueness of determinants –Classical adjoint of a (square) matrix –Inverse of an invertible matrix using determinants

UNIT – IV

DIAGONALIZATION: Invariant subspaces–Simultaneous triangulation – Simultaneousdiagonalization – Direct-Sum decompositions – Invariant direct sums – Primary Decomposition Theorem.

UNIT – V

THE RATIONAL AND JORDAN FORMS: Cyclic subspaces – Cyclic decomposition theorem (Statement only) – Generalized Cayley-Hamilton theorem – Rational forms – Jordan forms- computation of invariant factors.

TEXT BOOK:

1. Kenneth M Hoffman and Ray Kunze, Linear Algebra, Seventh Edition, Pearson India Education services, Noida, India, 2017.

UNIT – I	Chapter – 3	Sections 3.1 to 3.5
UNIT – II	Chapters – 4 & 5	Sections 4.1 to 4.5 & 5.1 to 5.2
UNIT – III	Chapters – 5 & 6	Sections 5.3, 5.4 & 6.1 to 6.3
UNIT – IV	Chapter – 6	Sections 6.4 to 6.8
UNIT – V	Chapter – 7	Sections 7.1 to 7.3

REFERENCE(S):

1. I.N. Herstein, “Topics in Algebra”, 2nd Edition, Wiley-Eastern Ltd., New Delhi, 2013.
2. M. Artin, “Algebra” Prentice-Hall of India Pvt. Ltd. 2005.
3. S.H. Friedberg, A.J. Insel and L.E. Spence, “Linear Algebra” 4th Edition, Prentice-Hall of India Pvt. Ltd, 2009.

Web Link:

1. <https://www.pdfdrive.com/topics-in-algebra-inherstein-e34321263.html>
2. <https://www.pdfdrive.com/linear-algebra-4th-edition-e187502855.html>
3. <https://www.pdfdrive.com/linear-algebra-2nd-ed-kenneth-hoffman-ray-kunze-1971pdf-e31944831.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22PMA2CC4	LINEAR 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 (✓) = 39 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
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Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	0	0	0	25	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22PMA2CC5
 Instruction Hours: 6
 Credits: 5

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

CORE COURSE – V– COMPLEX ANALYSIS

OBJECTIVES:

- To learn the various intrinsic concepts and the theory of Complex Analysis.
- To study the concept of Analyticity, Complex Integration and Infinite Products in depth.

COURSE OUTCOMES:

Making students to know

1. Prove that Cauchy's theorem for a rectangle and disk, Use Cauchy's integral theorem and formula to compute line integrals.
2. Classify Removable singularities, Zeros and poles and Describe the local mapping.
3. Demonstrate Homology and prove general form of Cauchy theorem.
4. Describe the harmonic functions and calculus of residue.
5. Complex analysis, in particular the theory of conformal mappings, has many physical applications and is also used throughout analytic number theory.

UNIT– I

COMPLEX INTEGRATION:

Fundamental Theorems: Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk.

Cauchy's Integral Formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives.

UNIT – II

LOCAL PROPERTIES OF ANALYTICAL FUNCTIONS: Removable Singularities-Taylor's

Theorem – Zeros and poles – The local Mapping –The Maximum Principle.

UNIT – III

THE GENERAL FORM OF CAUCHY'S THEOREM: Chains and cycles – Simple Continuity– Homology –The General statement of Cauchy's Theorem - Proof of Cauchy's theorem–Locally exact differentials –Multiply connected regions.

UNIT – IV

THE CALCULUS OF RESIDUE: Residue theorem –The argument principle–Evaluation of definite integrals.

HARMONIC FUNCTIONS: Definition of Harmonic function and basic properties –Mean value property – Poisson formula – Schwarz's Theorem.

UNIT – V

Conformal mappings of polygons:Behaviour at an angle – Schwarz-Christoffel formula – Mapping on a rectangle.

Harmonic Functions:Functions with mean value property – Harnack's principle.

TEXTBOOK:

1. Lars V. Ahlfors, Complex Analysis, Third Edition, McGraw-Hill Book Company, New York, 2016.

UNIT – I	Chapter – 4	Sections 1.4 to 1.5, 2.1 to 2.3.
UNIT – II	Chapter – 4	Sections 3.1 to 3.4
UNIT – III	Chapter – 4	Sections 4.1 to 4.7
UNIT – IV	Chapter – 4	Sections 5.1 to 5.3, 6.1 to 6.4
UNIT – V	Chapter – 6	Sections 1.1 to 1.3, 2.1 to 2.3, 3.1 to 3.2

REFERENCE(S):

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford, 1990.
2. John B. Conway, Functions of one Complex Variable, Second Edition, Springer Graduate Texts in Mathematics, New York, 1978.
3. S.Ponnusamy, Foundations of Complex Analysis, Second Edition, Narosa Publishing House, India, 2005

Web Link:

1. <https://nnquan.files.wordpress.com/2013/01/giao-trinh-ham-phuc.pdf>
2. <https://emineter.files.wordpress.com/2014/02/conway-functions-of-one-complex-variable-2ed-1978lt167s.pdf>
3. <https://www.teachmint.com/tfile/studymaterial/class-2nd/mathematics/complexanalysisponnusammypdf/bd2c1332-284e-4b8c-a78c-1208d8e87f84>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22PMA2CC5	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(✓) = 39						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
29	0	0	0	29	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22PMA2CC6

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – VI – PROGRAMMING IN C++

OBJECTIVES:

- Describe the object-oriented programming paradigm.
- Explain functions in C++, function prototyping, return by reference, inline functions and function overloading

COURSE OUTCOMES:

1. The learner will become proficient in object oriented programming concept in C++ tokens, operators, class declaration and definition and its objects.
2. Discuss the constructors and destructors.

3. Understand the concept of operator overloading and the concept inheritance.
4. Discuss the working with files and Exception Handling.
5. Demonstrate Standard Template Library, Manipulating Strings and Object Oriented Systems Development.

UNIT – I

Principles of Object Oriented Programming – Beginning with C++ - Tokens – Expressions and Control Structures – Functions in C++

UNIT – II

Classes and Objects – Constructors and Destructors – New Operator – Operator Overloading and Type Conversions

UNIT – III

Inheritance- Extending Classes – Pointers- Virtual Functions and Polymorphism

UNIT – IV

Managing Console I/O Operations – Working with Files – Templates –Exception Handling

UNIT – V

Standard Template Library – Manipulating Strings – Object Oriented Systems Development

TEXT BOOK:

1. Balagursamy E, Object Oriented Programming with C++, Tata McGraw Hill Publications, Sixth Edition, 2013

REFERENCE(S):

1. Ashok Kamthane, Programming in C++, Pearson Education, 2013.

Web Link:

1. <https://www.pdfdrive.com/c-programming-language-for-beginners-with-easy-tips-d176516054.html>
2. <https://www.youtube.com/watch?v=McojvctVsUs>
3. <https://www.youtube.com/watch?v=55IEuBLBTB8>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22PMA2CC6	PROGRAMMING IN C++					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 (✓) = 35					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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	0	0	0	20	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22PMA2CCC2:1

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE CHOICE COURSE – II– PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:

- To give an in-depth knowledge of solving partial differential equations and apply them in scientific and engineering problems.

- To study the other aspects of PDE

COURSE OUTCOMES:

The students can be able to

1. Describe real world system using Partial Differential Equations
2. Identify, analyse, and subsequently solve physical situations whose behavior can be described by Partial Differential Equations.
3. To gain the knowledge about laplace's equation
4. To the study and solution methods of solving WaveEquations
5. Understand the concept of the diffusion equation and separation of variables.

UNIT – I

PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER :Partial Differential Equations – Origins of First Order Differential Equations – Cauchy's Problem for first order equations– Linear Equations of the first order– Cauchy's method of characteristics– Compatible system of First order Equations-Jacobi's method

UNIT – II

PARTIAL DIFFERENTIAL EQUATIONS OF THE 2nd ORDER :The Origin of Second Order Equations – Second order equations in physics – Higher Order Equations in physics- Linear partial Differential Equations with constant coefficients – Equations with variable coefficients – Characteristics of equations in three variables –The solution of linear hyperbolic equations

UNIT- III

LAPLACE'S EQUATION :Elementary solutions of Laplace equation – Families of Equipotential Surfaces – Boundary value problems – Separation of variables– Surface Boundary Value Problems – Separation of Variables – Problems With Axial Symmetry – The Theory of Green's Function for Laplace Equation.

UNIT – IV

THE WAVE EQUATION :The Occurrence of the wave equation in Physics – Elementary Solutions of the One – dimensional Wave equations – Vibrating membrane-**Application** of the calculus of variations – Three dimensional problem – General solutions of the Wave equation.

UNIT – V

THE DIFFUSION EQUATION:Theresolution of boundary value problems for the diffusion equations- Elementary Solutions of the Diffusion Equation – Separation of variables – **Theuse ofIntegral** Transforms – **Theuse ofGreen's** functions

TEXT BOOK:

1. Ian N. Sneddon, Elements of Partial differential equations, McGraw-Hill Book Company, New Delhi, 1983.

UNIT – I	Chapter – 2	Sections 1 to 4, 8,9 13
UNIT – II	Chapter – 3	Sections 1, 4, 5, 9 to 11
UNIT – III	Chapter – 4	Sections 2 to 6, 8
UNIT – IV	Chapter – 5	Sections 1, 2, 4 to 6
UNIT – V	Chapter – 6	Sections 2 to 6

REFERENCE(S):

1. M.D. Raisinghania Advanced Differential Equations S. Chand and Company Ltd., New Delhi, 2001.
2. K. SankaraRao, Introduction to Partial Differential Equations, Second edition – Prentice – Hall of India, New Delhi 2006.
3. J.N. Sharma & K. Singh, Partial Differential Equations for Engineers & Scientists, Narosa Publishing House, 2001.

Web Link:

1. <https://books.google.co.in/books?id=egwrDAAAQBAJ&q=PDF#v=onepage&q=PDF&f=false>
2. <https://www.pdfdrive.com/introduction-to-partial-differential-equations-e25964678.html>
3. <http://sharif.edu/~asghari/Handbook%20of%20linear%20partial%20differential%20equations%20for%20engineers%20and%20scientists%20-%20Polyanin.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22PMA2CCC2:1	PARTIAL DIFFERENTIAL EQUATIONS					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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
33	3	3	3	33	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – II

Course Code: 22PMA2CCC2:2

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 4

External Marks: 75

CORE CHOICE COURSE – II –PROBABILITY THEORY**OBJECTIVES:**

- To understand about fields, σ -fields and random variables.
- To know about Expectations, Convergence in random variables and distribution functions.

COURSE OUTCOMES:

1. The learner gain knowledge of Sets, Fields and Class of events.
2. Define Probability, Discrete probability space and its Properties.
3. Describe Distribution function of a random variable and Correspondence theorem.
4. Students will be able to calculate the Expectation and Moments.
5. Understand the concept of Convergence in Probability and Convergence theorems for Expectations.

UNIT – I**SETS AND CLASSES OF EVENTS:** Fields and σ Fields– Class of events.**RANDOM VARIABLES:** Functions and Inverse functions – Random variables**UNIT – II****PROBABILITY SPACE:** Definition of probability – Some simple properties – Discrete probability space –General probability space**UNIT – III****DISTRIBUTION FUNCTIONS:** Distribution functions of a random variable –Decomposition of distributive functions -Distributive functions of vector random variables – Correspondence theorem.**UNIT – IV****EXPECTATION AND MOMENTS:**Definition of Expectation –Properties of expectation – Moments in Qualities.**UNIT – V****CONVERGENCE OF RANDOM VARIABLES:** Convergence in Probability –Convergence almost surely – Convergence in distribution – Convergence in the r^{th} mean.**TEXT BOOK:**

1. B.R. Bhat, Modern Probability Theory, Third edition, New Age International private ltd, New Delhi, 2007.

UNIT – I	Chapters – 1& 2	Sections 1.3, 1.4 & 2.1 to 2.3
UNIT – II	Chapter – 3	Sections 3.1 to 3.5
UNIT – III	Chapter – 4	Sections 4.1 to 4.4
UNIT – IV	Chapter – 5	Sections 5.1 to 5.3
UNIT – V	Chapter – 6	Sections 6.1 to 6.5

REFERENCE(S):

1. Chandra T.K and Chatterjee D, A first course in probability, Second Edition, Narosa Publishing House, New Delhi, 2003.

2. Kailai Chung and Farid Aitsahlia, Elementary Probability, Springer Verlag 2003, New York.
3. Marek Capinski and Thomasz Zastawniak, Probability through problems, Springer Verlag, New York, 2003.
4. Sharma .T.K, A text book of probability and theoretical distribution, Discovery publishing house, New Delhi, 2005.

Web Link:

1. http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/501_06_Rohatgi_An-Introduction-to-Probability-and-Statistics-Wiley-2015.pdf
2. <https://link.springer.com/book/10.1007/978-0-387-21659-1>
3. <https://books.google.co.in/books?id=g8rFmwU0cEIC&pg=PA148&lpg=PA148&dq=Sharma+.T.K,+A+text+book+of+probability+and+theoretical+distribution&source=bl&ots=6LnEYLEP8t&sig=ACfU3U0RWvnmwBE4z2mh57LWF0HkBM0svw&hl=en&sa=X&ved=2ahUKEwiDrvHOzoP3AhXamlYBHQINDGMQ6AF6BAgtEAM#v=onepage&q=Sharma%20.T.K%2C%20A%20text%20book%20of%20probability%20and%20theoretical%20distribution&f=false>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22PMA2CCC2:2	PROBABILITY THEORY					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 (✓) = 33					Relationship: MODERATE						

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
Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
19	0	0	0	19	Global

Green - Local, Pink - Regional, Blue - National, Brown - Global

SEMESTER – II

Course Code: 22PMA2EC2:1
 Instruction Hours: 5
 Credits: 4

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

ELECTIVE COURSE – II – FUZZY SETS AND THEIR APPLICATIONS**OBJECTIVES:**

- To introduce the concept of fuzzy theory and study its application in real problems.
- To study the uncertainty environment through the fuzzy sets that incorporates imprecision and subjectivity into the model formulation and solution process.

COURSE OUTCOMES:

1. Form Classical Sets to fuzzy sets and operator.
2. Illustrate operation on fuzzy sets.
3. Classify fuzzy relations and properties of fuzzy relations.
4. Demonstrate the fuzzy decision making, fuzzy ranking methods and fuzzy linear programming.
5. To mold the students in research/teaching or to find better placement in corporate sectors.

UNIT– I

CRISP SETS AND FUZZY SETS: Overview of Classical Sets-Membership Function-Height of a fuzzy set – Normal and sub normal fuzzy sets – Support- Level sets - fuzzy points- α -cuts – Decomposition Theorems- Extension Principle.

UNIT – II

OPERATION ON FUZZY SETS: Standard fuzzy operations – Union– intersection and complement – Properties De. Morgan's laws- Aggregation operations.

FUZZY ARITHMETIC : Fuzzy Numbers – Linguistic variables – Arithmetic operations on interval – Arithmetic operations on Fuzzy numbers- Lattice of Fuzzy numbers.

UNIT – III

FUZZY RELATIONS: Crisp and Fuzzy Relations – Projections and Cylindric Extensions – Binary Fuzzy Relations – Binary Relations on a single set – Fuzzy Equivalence Relations - Fuzzy Compatibility Relations – Fuzzy ordering Relations– Fuzzy Morphisms.

UNIT –IV

DECISION MAKING IN FUZZY ENVIRONMENTS: General Discussion – Individual Decision making – Multi person decision making – Multi criteria decision making – Multi stage decision making – Fuzzy ranking methods – Fuzzy linear programming.

UNIT – V

APPLICATIONS: Medicine – Economics – Fuzzy Systems and Genetic Algorithms – Fuzzy Regression– Interpersonal Communication – Other Applications.

TEXT BOOK:

1. George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 2004.

UNIT – I	Chapters – 1 & 2	Sections 1.2 to 1.4 & 2.1 to 2.3
UNIT – II	Chapter – 3	Sections 3.1 to 3.6
UNIT – III	Chapter – 5	Sections 5.1 to 5.8

UNIT – IV	Chapter –15	Sections 15.1 to 15.7
UNIT – V	Chapter – 17	Sections 17.2 to 17.7

REFERENCE BOOKS:

1. A. K. Bhargava; Fuzzy Set Theory, Fuzzy Logic and their Applications, published by S. Chand Pvt. Limited (2013).
2. K.Pundir and R.Pundir, Fuzzy sets and their application, Published by A Pragati edition (2012)
3. H.J.Zimmermann, Fuzzy set theory and its applications, Springer (2012).

Web Link:

1. <https://cours.etsmtl.ca/sys843/REFS/Books/ZimmermannFuzzySetTheory2001.pdf>
2. <https://www.pdfdrive.com/an-introduction-to-fuzzy-logic-and-fuzzy-sets-e157643851.html>
3. <https://www.pdfdrive.com/introduction-to-fuzzy-sets-fuzzy-logic-and-fuzzy-control-systems-e156646351.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
II	22PMA2EC2:1	FUZZY SETS AND THEIR APPLICATIONS					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(✓) = 38 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

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

Topics					
41	1	1	1	41	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22PMA2EC2:2

Instruction Hours: 5

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ELECTIVE COURSE – II – NUMERICAL ANALYSIS

OBJECTIVES:

- To develop a sound knowledge and appreciation the ideas and concepts related to polynomials, Interpolation.
- To give a strong foundation to take up advanced level courses in analysis.

COURSE OUTCOMES:

1. Apply Chebyshev Method, Multipoint, Iteration Methods, Bridge Vieta Method, BaristowMethod, Graeffe's root Squaring Method.
2. Use Iteration Methods to solve Jacobi Method, Guass Seidel Method.
3. Finding solution of Interpolation use to Hermite Interpolation, Piecewise cubic Interpolation and cubic Spline, Lagrange and Newton's and Bivariate interpolation
4. Calculate the numerical differentiation, partial differentiation, Integration.
5. Solving numerical methods for using Euler, Mid-Point Method, Runge-kutta Methods, Implicit Runge-Kutta Methods and Predictor – Corrector Methods

UNIT – I

Iteration methods based on second degree equation: Chebyshev Method – Multipoint Iteration Methods – Bridge Vieta Method – Bairstow Method – Graeffe's Root Squaring Method.

UNIT – II

Iteration Methods: Jacobi Iteration Method – Gauss Siedel Iteration Method – Successive over Relaxation Method – Iterative Method to determine A^{-1} – Eigen values and Eigen Vectors – Jacobi Method for symmetric Matrices – Power Method.

UNIT – III

Interpolation and Approximation: Hermite Interpolation - Piecewise and Spline Interpolation – Cubic spline interpolation – Bivariate interpolation – Lagrange and Newton's Bivariate interpolation – Least square approximation – Gram -Schmidt orthogonalizing process.

UNIT – IV

Differentiation and Integration: Numerical Differentiation – Methods Based on Interpolation – Partial Differentiation – Numerical Integration – Methods Based on Interpolation – Methods Based on Undetermined Coefficients – Gauss Quadrature methods - Gauss Legendre and Gauss Chebyshev Integration Methods – Double Integration – Trapezoidal and Simpson's Method – Simple Problems.

UNIT – V

Solution of Ordinary Differential Equations: Euler method - Backward Euler's Method – Midpoint method - Taylor series Method – Rungekutta Method – Implicit RungeKutta methods - PredictorCorrector methods.

TEXT BOOK:

1. M.K.Jain, S.R.K. Iyenger, R.K.Jain, Numerical Methods for Scientific and Engineering computation, Forth Edition, 2003.

UNIT – I	Chapter – 2	Sections 2.4, 2.9
UNIT – II	Chapter – 3	Sections 3.4 to 3.6
UNIT – III	Chapter – 4	Sections 4.5 to 4.7, 4.9
UNIT – IV	Chapter – 5	Sections 5.2, 5.5 to 5.8, 5.11
UNIT – V	Chapter – 6	Sections 6.3, 6.4, 6.7

REFERENCE(S):

1. M.K.Jain, Numerical Solution of Differential Equations, Second Edition, New age international pvt Ltd., 1983.
2. S.S. Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India, New Delhi, 1998.
3. M.K.Jain, S.R.K. Iyenger, R.K.Jain, Numerical Methods (problems and Solutions) Wiely Eastern Limited. 1994.

Web Link:

1. <https://freevideolectures.com/course/3504/numerical-methods-of-ordinary-and-partial/1>
2. <https://www.classcentral.com/course/swayam-numerical-methods-for-engineers-14213>
3. <https://wp.kntu.ac.ir/ghoreishif/ODEjain.pdf>
4. <https://www.pdfdrive.com/introductory-methods-of-numerical-analysis-by-ss-sastry-e148704487.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22PMA2EC2:2	NUMERICAL 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 (✓) = 35						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
37	0	0	0	37	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22PMA2NME1:1

Instruction Hours: 3

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

NON - MAJOR ELECTIVE – I– STATISTICS

COURSE OBJECTIVES:

1. To introduce the concepts involved in basic statistics and learn them with plenty of demonstrating examples.
2. To emphasize the correct statistical tools required to analyze and understand the results based on them.

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Collect, classify and tabulate a given data and study graphical and diagrammatic representations through Bar diagrams, Pie diagram, Histogram, Frequency polygon
2. Understand measures of central tendency, viz., Mean, Median and Mode in series of individual observations.
3. Analyze measures of dispersion namely range, quartile deviation, Mean deviation about mean, standard deviation and co-efficient of variation for individual, discrete and continuous type data.
4. Distinguish different types of correlation Calculate Karl Pearson's correlation coefficient for a lot of problems
5. Compute partial and multiple regression coefficient for a plenty of problems.

UNIT – I

Collection- classification and tabulation of data - graphical and diagrammatic - Bar diagrams - Pie diagram – Histogram - Frequency polygon - frequency curve and Ogive.

UNIT – II

Measures of central tendency: Mean - Median - Mode – Geometric Mean – Harmonic Mean – Selection of an average – Partition Values.

UNIT – III

Measures of dispersion: Range - Quartile deviation - Mean deviation about an average - Standard deviation - co-efficient of variation for individual - discrete and continuous type data.

UNIT – IV

Correlation: Different types of correlation – Positive – Negative– Simple - Partial - Multiple - Linear and non-Linear correlation - Methods of correlation – Karl Pearson’s Spearman’s correlations and Concurrent deviation.

UNIT – V

Regression:Regression types and method of analysis - Regression line -Regression equations - Deviation taken from arithmetic mean of X and Y - Deviation taken from assumed mean - Partial and multiple regression coefficients - **Applications**

REFERENCES:

1. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 1994.
2. Freund J.E.(2001); Mathematical Statistics, Prentice Hall of India.
3. Goon, A.M., Gupta M.K., Dos Gupta, B, (1991), Fundamentals of Statistics, Vol. I, World Press, Calcutta.

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
2. <https://www.pdfdrive.com/statistics-601-advanced-statistical-methods-e387419.html>
3. <https://www.pdfdrive.com/mathematicsprobability-and-statisticsapplied-mathematics-e16657497.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	22PMA2NME1:1	STATISTICS					3	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 (✓)= 35					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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
37	1	1	1	37	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – II

Course Code: 22PMA2NME1:2

Instruction Hours: 3

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

NON – MAJOR ELECTIVE – I – DISCRETE MATHEMATICS

OBJECTIVES:

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

COURSE OUTCOMES:

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

1. Understand the concepts of mathematical logics such as connections, concept of tautology, etc.,
2. Gains knowledge in disjunctive and conjunctive normal forms.
3. Study the concepts of predicate calculus, Relations and ordering.
4. Learn about partially ordered the set, lattices and their types.
5. Understand Boolean algebra and Boolean functions.

UNIT – I

Statement and notation: Connectives – Negative – Conjunctive – Disjunctive– Statement Formulae and Truth tables – Conditional and Bi conditional statements.

UNIT – II

Statement and notation(Continued): Well defined formulae – Tautologies.

Normal forms: Disjunctive Normal forms – Conjunctive Normal forms.

UNIT – III

Relations and Ordering: Relations – Properties of Binary relations in a set – Relation matrix and the graph of a relation – Equivalence relation – Composition of a binary relation.

UNIT – IV

Lattice as partially ordered set: 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 to 1.2.4, 1.2.6
UNIT – II	Chapter – 1	Sections 1.2.7 & 1.2.8, 1.3.1 & 1.3.2.
UNIT – III	Chapter – 2	Sections 2.3.1 to 2.3.3, 2.3.5 & 2.3.7
UNIT – IV	Chapter – 4	Section 4.1
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				
II	22PMA2NME1:2	DISCRETE MATHEMATICS				3	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 (✓) = 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	1	1	1	25	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PMA3CC7

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – VII – TOPOLOGY

OBJECTIVES:

- To develop the knowledge of Topological spaces and continuity.
- To analyse the concept of connectivity and compactness.

COURSE OUTCOMES:

- Define topological spaces and explain the properties of order topology, product topology, subspace topology, continuous functions.
- Describe the properties on metric topology
- Gain the knowledge of connected spaces.
- Apply domain knowledge for compact space with examples.
- State and prove Urysohn lemma, Urysohn Metrization theorem.

UNIT – I

TOPOLOGICAL SPACES: Topological spaces–Basis for a Topology – The order Topology - The Product Topology on $X \times Y$ – The subspace Topology – Closed sets and Limit points.

UNIT – II

CONTINUOUS FUNCTIONS: Continuous functions – The Product Topology – The Metric Topology (Continued)

UNIT – III

CONNECTEDNESS: Connected spaces–Connected subspaces of the Real line–Components and Local Connectedness.

UNIT – IV

COMPACTNESS: Compact spaces– Compact subspaces of the Real line – Limit Point Compactness – Local Compactness.

UNIT – V

COUNTABILITY AND SEPARATION AXIOMS: The Countability Axioms– The separation Axioms– Normal spaces– The Urysohn Lemma - The Urysohn Metrization Theorem–Complete metric spaces.

TEXT BOOK:

1. James R. Munkres, Topology, Second Edition, Pearson Education Pvt. Ltd., New Delhi, 2011.

UNIT – I	Chapter – 2	Sections 12 to 17
UNIT – II	Chapter – 2	Sections 18 to 21
UNIT – III	Chapter – 3	Sections 23 to 25
UNIT – IV	Chapter – 3	Sections 26 to 29
UNIT – V	Chapter – 4 & 7	Sections 30 to 34 & 43

REFERENCE(S):

1. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Co., 1963
2. Fred H. Croom, Principles of Topology, Cengage India Pvt Ltd, New Delhi (2009)
3. Seymour Lipschutz, Theory and Problems of General Topology, McGraw-Hill Edition, New Delhi (2006).

Web Link:

1. <https://www.pdfdrive.com/simmons-introduction-to-topology-and-modern-analysis-e18825335.html>
2. <https://www.pdfdrive.com/principles-of-topology-e191465016.html>
3. <https://www.pdfdrive.com/schaums-outline-of-general-topology-schaums-outlines-e164863315.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
III	22PMA3CC7	TOPOLOGY	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(✓) = 40					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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
22	0	0	0	22	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER –III

Course Code: 22PMA3CC8
 Instruction Hours: 6
 Credits: 5

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

CORE COURSE – VIII – CALCULUS OF VARIATIONS, INTEGRAL EQUATIONS AND TRANSFORMS**OBJECTIVES:**

- To introduce various types of Integral Equations and Integral Transforms and to solve these equations.
- To understand the concept of Calculus of variation and its applications.

COURSE OUTCOMES:

1. Describe calculus of variations and applications.
2. Discuss regularity conditions and prove Fredholm alternative and Describe method of successive approximations and Volterra Integral
3. Explain applications to ordinary differential equations of Initial value boundary value problems and Illustrate and discuss singular integral equations to Abel integral equation.
4. Gain the knowledge about Fourier transforms and Parseval's Theorems.
5. Demonstrate Hankel transforms and its properties.

UNIT – I

CALCULUS OF VARIATIONS: Variation and its properties – Euler's (Euler Lagrange's) equation – functional dependent on the functions of several independent variables – Variational problems in parametric form – Applications

UNIT – II

INTEGRAL EQUATIONS: Types of Integral equations – Integral Fredholm Alternative-Approximate method – Equation with separable Kernel–Volterra integral equations – Fredholm's theory.

UNIT – III

APPLICATION OF INTEGRAL EQUATIONS TO ORDINARY INTEGRAL EQUATIONS and SINGULAR INTEGRAL EQUATIONS:

Initial value problems- Boundary value problems – Singular integral equations – Abel Integral equation

UNIT – IV

FOURIER TRANSFORMS: Fourier Transforms– Fourier sine and cosine transforms – Fourier transforms of derivatives – Convolution integral – Parseval's Theorem–Solution of Laplace Equations by Fourier transform.

UNIT – V

HANKEL TRANSFORMS: Properties of Hankel Transforms – Hankel transformation of derivatives of functions – The Parseval's relation.

TEXT BOOK(S):

1. L. Elsgolts, Differential Equations and Calculus of Variations, Mir Publishers, Moscow, 1970
2. R.P. Kanwal, Linear Integral Equations Theory and Technique, Academic Press, New York, 1971.
3. Vasishtha, Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2008.

UNIT – I	Chapter – 6	Sections 1, 2, 5 to 7 of [1]
UNIT – II	Chapters – 1 & 2 Chapters – 3 & 4	Sections 1.1 to 1.7 & 2.3 to 2.5 of [2] Sections 3.3 to 3.4 & 4.1 to 4.5 of [2]
UNIT – III	Chapters – 5 & 8	Sections 5.1 to 5.3 & 8.1 to 8.2 of [2]
UNIT – IV	Chapter – 6	Sections 6.1 to 6.21 of [3]
UNIT – V	Chapter – 9	Sections 9.1 to 9.7 of [3]

REFERENCE(S):

1. Shanti Swarup, Integral Equations, Krishna Prakashan Media Ltd, Meerut, 1982.

2. I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966.

Web Link:

1. <https://www.ams.org/journals/qam/1968-25-04/S0033-569X-1968-0226328-3/S0033-569X-1968-0226328-3.pdf>
2. <https://www.pdfdrive.com/calculus-of-variations-e187405674.html>
3. <https://ia600908.us.archive.org/2/items/ElsgoltsDifferentialEquationsAndTheCalculusOfVariations/Elsgolts-Differential-Equations-and-the-Calculus-of-Variations.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
III	22PMA3CC8	CALCULUS OF VARIATIONS, INTEGRAL EQUATIONS AND TRANSFORMS					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(✓) = 36						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	1	1	1	24	Global

Green - Local, Pink - Regional, Blue - National, Brown - Global

SEMESTER – III

Course Code: 22PMA3CP1

Instruction Hours: 6

Credits: 3

Exam Hours: 3

Internal Marks: 40

External Marks: 60

CORE COURSE PRACTICAL – I - PROGRAMMING IN C++ (PRACTICAL)**COURSE OUTCOMES:**

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

- To familiarize the students with language environment.
- To implement various concepts related to language.
- Identify importance of object oriented programming and difference between structured oriented and object oriented programming features.
- Able to make use of objects and classes for developing programs.
- Able to use various object oriented concepts to solve different problems.

1. Classes

Write a Program using a class to represent a Bank Account with Data Members – Name of depositor - Account Number - Type of Account and Balance and Member Functions – Deposit Amount – Withdrawal Amount - Show name and balance - Check the program with own data.

2. Constructor & Destructor

Write a program to read an integer and find the sum of all the digits until it reduces to a single digit using constructor-destructor and default constructor.

3. Default & Reference Argument

Write a program using function overloading to read two matrices of different data types such as integers and floating point numbers - Find out the sum of the above matrices separately and display the total sum of these arrays individually.

4. Operator Overloading

- a. Addition of Two Complex Numbers.
- b. Matrix Multiplication

5. Inheritance

Prepare Pay Roll of an employee using Inheritance

6. Pointers

- a. Write a Program to find the number of vowels in a given text
- b. Write a Program to check for Palindrome

7. Files

- a. Prepare Students Mark List in a file with Student Number, Mark in four subjects and Mark Total.
- b. Write a program to arrange these records in the ascending order of Mark Total and write them in the same file overwriting the earlier records.

8. Exception Handling

Prepare Electricity Bill for customers generating and handling any two Exceptions.

Web Link:

1. <https://www.youtube.com/watch?v=xE5WMhTle88>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	22PMA3CP1	PROGRAMMING IN C++ (PRACTICAL)					6	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(✓) = 35						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	0	0	0	20	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PMA3CCC3:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

CORE CHOICE COURSE– III – MEASURE THEORY AND INTEGRATION**OBJECTIVES:**

- To understand Measure on a Real Line, Borel Measure, Lebesgue Measure, Measure on Measurable Space.
- To acquire the knowledge of L^p Space and Product Space.

COURSE OUTCOMES:

1. Define the basic properties on sets in real line and Measure on a real line, Outer measure, measurable sets and measurable functions.
2. Discuss the Riemann and Lebesgue Integrals
3. Understand the signification of abstract measure space.
4. Prove Hahn Decomposition and Jordan Decomposition.
5. State and prove Radon Nikodym theorem and Fubini's theorem.

UNIT – I

Measure on the Real line: Lebesgue outer measure - Measurable Sets - Regularity - Measurable function - Borel and Lebesgue measurability.

UNIT - II

Integration of Functions of a Real Variable: Integration of non-negative functions - The General Integral - Integration of Series - Riemann and Lebesgue Integrals.

UNIT – III

Abstract Measure spaces: Measures and Outer Measures – Extension of a Measure – Uniqueness of the Extension- Completion of a Measure - Measure spaces.

UNIT – IV

Convergence: Convergence in Measure- Almost Uniform Convergence.

Signed Measures and Their Derivatives: Signed Measures and the Hahn Decomposition – The Jordan Decomposition – The Radon-Nikodym Theorem.

UNIT – V

Measure and Integration in a Product space: Measurability in a Product space – The product Measure and Fubini's Theorem.

TEXT BOOK:

1. G.De Barra, Measure Theory and Integration, New age international Publishing Limited, 2011.

UNIT – I	Chapter – 2	Sections 2.1 to 2.5
UNIT – II	Chapter – 3	Sections 3.1 to 3.4
UNIT – III	Chapter – 5	Sections 5.1 to 5.5
UNIT – IV	Chapters – 7 & 8	Sections 7.1, 7.2 & 8.1 to 8.3
UNIT – V	Chapter – 10	Sections 10.1 & 10.2

REFERENCE(S):

1. M.E. Munroe, Measure and Integration, Addison - Wesley Publishing Company, Second Edition, 1971.
2. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited Publishers, New Delhi, 1986. (Reprint 2000).
3. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
4. Inder, K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi, 1997.

Web Link:

1. <http://webpages.iust.ac.ir/tnikazad/real.pdf>
2. [https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jun/4_06-11-2021_16-20-07_Measure%20and%20Integration%20Theory\(20MAT22C2\)%20\(2\).pdf](https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jun/4_06-11-2021_16-20-07_Measure%20and%20Integration%20Theory(20MAT22C2)%20(2).pdf)
3. <https://library.oapen.org/bitstream/id/ce19d94d-b8b6-420f-9e69-d9f565703c26/1007045.pdf>
4. <https://vdoc.pub/documents/measure-and-integral-an-introduction-to-real-analysis-4oebisqugnm0>

Semester	Code	Title of the Course					Hours	Credits			
III	22PMA3CCC3:1	MEASURE THEORY AND INTEGRATION					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 (✓) = 36						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	0	0	0	21	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PMA3CCC3:2

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE CHOICE COURSE– III– METHODS OF MATHEMATICAL PHYSICS

OBJECTIVES:

- To understand the concept of Bessel functions, Hermitian polynomials.
- To acquire knowledge of non-homogeneous boundary value problems.

COURSE OUTCOMES:

Upon completion of this course the student will be able to

1. Solve Boundary value problems and series solution with examples.
2. Derive Bessel functions and its Kinds of nature.
3. Solve Liouville problem, Laguerre polynomials and Dirac Delta function.
4. Understand Non homogeneous boundary value problems and Eigen function expansion of Green's function.
5. Understand Green's function in higher dimensions and Wave equation with source.

UNIT - I

Boundary value problems and series solution - Examples of boundary value problems - Eigen values - Eigen functions - The Sturm Liouville problem.

UNIT - II

Bessel functions - Bessel functions of the second kind - Legendre polynomials - Associated Legendre polynomials and spherical harmonics.

UNIT - III

Hermite polynomials- Laguerre polynomials - The Gamma function - The Dirac Delta function

UNIT - IV

Non homogeneous boundary value problems and Green's function - Green's function for one dimensional problems– Eigen function expansion of Green's function

UNIT - V

Green's function in higher dimensions - Green's function for Poisson's equation and a formal solution of electrostatic boundary value problems .

TEXT BOOK:

1. P.K. Chattopadhyay, Mathematical Physics, Wiley Eastern Limited, 1990.

UNIT – I Chapter – 4 Sections 4.2 to 4.4

UNIT – II Chapter – 5 Sections 5.1, 5.2, 5.4 & 5.5

UNIT – III	Chapter – 5	Sections 5.6 to 5.9
UNIT – IV	Chapter – 6	Sections 6.1 to 6.4
UNIT – V	Chapter – 6	Sections 6.5 to 6.7

REFERENCE(S):

1. B.D. Gupta, Mathematical Physics, Vikas Publishing House Pvt Ltd, New Delhi, 1993.
2. Goyal A.K. Ghatak, Mathematical Physics, Differential Equations and Transform Theory, McMillan India Ltd, 1995.
3. Kryzeg, Higher Engineering Mathematics.

Web Link:

1. <http://196.189.45.87/bitstream/123456789/79541/4/Mathematical%20Physics%20%28Gupta%29.pdf>
2. <https://pdfcoffee.com/mathematical-physics-bdguptapdf-pdf-free.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	22PMA3CCC3:2	METHODS OF MATHEMATICAL PHYSICS					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 (✓) = 36						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
18	1	1	1	18	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PMA3EC3:1

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ELECTIVE COURSE – III – APPLIED STATISTICS

OBJECTIVES:

- To introduce the concepts involved in basic statistics and learn them with plenty of demonstrating examples
- To emphasize the correct statistical tools required to analyze and understand the results based on them.

COURSE OUTCOMES:

1. To Know the basic concepts of control charts and their applications.
2. To study the concepts of time-series analysis
3. Understanding the concepts involved in index numbers
4. Analyzing the concepts of demand analysis and their related methods
5. Understanding the concepts of Analysis of one-way and two-way classification

UNIT - I

STATISTICAL QUALITY CONTROL:

Introduction –Process & Product Control-Control Charts– VControl Limits – Tools of S.Q.C –Control chart for attributes- Control chart for number of defects per unit (C-Charts).

UNIT - II

TIME SERIES ANALYSIS (Excluding the moving average mathematical treatment):

Introduction - Components of Time series-Analysis of Time Series-Measurement of Trend –Measurement of Seasonal Fluctuations.

UNIT - III

INDEX NUMBERS:

Introduction-Problems involved in the construction of index numbers-The criteria of a good index number-Classification of index numbers.

UNIT - IV

DEMAND ANALYSIS:

Introduction-Price elasticity of demand- Partial elasticities of demand –Types of Data required for estimating elasticities-Engel’s law and Engel’s curve- Pareto’s law of income Distribution-Utility function.

UNIT - V

ANALYSIS OF VARIANCE:

Introduction- One-way classification – Two-way classification- Analysis of Twoway classified data with Mobservations per cell.

TEXT BOOK (S)

- S. C gupta and v.k. Kapoor fundamentals of applied statistics, sultan chand & sons – third edition,

UNIT - I	Chapter 1	Sections 1.0 to 1.7
UNIT - II	Chapter 2	Sections 2.1 to 2.5
UNIT - III	Chapter 3	Sections 3.1 to 3.4
UNIT - IV	Chapter 4	Section 4.1 to 4.7
UNIT - V	Chapter 5	Section 5.1 to 5.4

REFERENCE BOOK[s]

- D.r. Caze – Applied Statistics – Principle and Examples
- B.n. Ashana – Applied Statistics

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	22PMA3EC3:1	APPLIED STATISTICS					6	4			
Course Outcomes (COs)	ProgrammeOutcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓		✓	
CO2	✓			✓	✓		✓		✓		
CO3		✓	✓		✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓		✓	✓	✓	
CO5	✓	✓	✓	✓			✓	✓	✓	✓	
Number of Matches (✓) = 38						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

Total	Number of Topics	Category
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Number of Topics	Local	Regional	National	Global	Based on %
27	0	0	0	27	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PMA3EC3:2

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ELECTIVE COURSE – III –FINANCIAL MATHEMATICS

OBJECTIVES:

- To know the financial mathematics through various models.
- To apply the various aspects of financial mathematics.

COURSE OUTCOMES:

This course will enable the students to

1. Understand financial markets and derivatives including options and futures.
2. Appreciate pricing and hedging of options, interest rate swaps and no-arbitrage pricing concepts.
3. Study and use Hedging parameters, trading strategies and currency swaps.
4. Understood Levy's Construction of Brownian motion and Martingales in Continuous time.
5. Learn stochastic analysis, Ito's formula, Ito integral and the Black–Scholes model.

UNIT - I

SINGLE PERIOD MODELS: Definitions from Finance - Pricing a forward – One step Binary Model - a ternary Model- Characterization of no arbitrage – Risk Neutral Probability Measure.

UNIT - II

BINOMIAL TREES AND DISCRETE PARAMETER MARTINGALES: Multi period Binary model - American Options - Discrete parameter martingales and Markov processes - Martingale Theorems - Binomial Representation Theorem - Overturn to Continuous models.

UNIT - III

BROWNIAN MOTION: Definition of the process - Levy's Construction of Brownian Motion - The Reflection Principle and Scaling- Martingales in Continuous time.

UNIT - IV

STOCHASTIC CALCULUS: Non differentiability of Stock prices - Stochastic Integration - Ito's formula - Integration by parts and Stochastic Fubini Theorem - Girsanov Theorem -Brownian Martingale Representation Theorem – Geometric Brownian Motion - The Feynman Kac Representation.

UNIT - V

BLOCK-SCHOLES MODEL: Basic Block Scholes Model – Block Scholes price and hedge for European Options - Foreign Exchange -Dividends - Bonds - Market price of risk.

TEXT BOOK:

1. Alison Etheridge, A Course in Financial Calculus, Cambridge University Press, Cambridge, 2002.

REFERENCE(S):

1. Martin Boxtter and Andrew Rennie, Financial Calculus: An Introduction to Derivatives Pricing, Cambridge University Press, Cambridge, 1996.
2. Damien Lamberton and Bernard Lapeyre, (Translated by Nicolas Rabeau and FrancoisMantion), Introduction to Stochastic Calculus Applied to Finance, Chapman and Hall, 1996.
3. MarekMusielka and MarekRutkowski, Martingale Methods in Financial Modeling, Springer Verlag, New York, 1988.
4. Robert J.Elliott and P.Ekkehard Kopp, Mathematics of Financial Markets, Springer Verlag, New York, 2001 (3rd Printing).

Web Link:

1. <https://www.pdfdrive.com/financial-calculus-d85508935.html>
2. <https://www.pdfdrive.com/introduction-to-stochastic-calculus-applied-to-finance-second-edition-e189575436.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	22PMA3EC3:2	FINANCIAL MATHEMATICS					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(✓) = 36 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
30	0	0	0	30	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PVAMA2:1
Instruction Hours:
Credits: 2

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

VALUE ADDED COURSE – II – VEDIC MATHEMATICS

OBJECTIVES

- To develop the thinking capacity.
- To inquire many short tricks to solve problems
- Facilitate the habit of analytical thinking and measured approach towards any.

COURSE OUTCOMES

On completion of the course the student will be able:

1. To acquire basic knowledge of finding imperfect squares.
2. Compute the short cut methods of finding Cubes.
3. Solve the division problems with base methods.
4. Understand the concept of higher powers.
5. To gain the knowledge of Pythagorean values.

UNIT – I

Square Roots of Imperfect Squares- Characteristics - Method– Simple Problems.

UNIT – II

Cubing Numbers - Method One: Formula Method – Method Two: The Anurupya Sutra - The Rule of Zeros - Simple Problems..

UNIT – III

Base Method of Division – Format - Bigger Divisors - Simple Problems..

UNIT – IV

Division (Part Two)- Substitution Method - Divisibility Tests - Raising to fourth and higher powers.

UNIT – V

Pythagorean Values - Co-ordinate Geometry - Traditional Method One & Two - Vedic Mathematics Method.

TEXT BOOK:

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

REFERENCE BOOK:

1. BharatiKrsnaTirthaji Maharaja, Vedic Mathematics, MotilalBanarsidass Publishers Private Ltd, Delhi, Re-Print 2004
2. Ronak Bajaj, Vedic Mathematics, Black Rose Publications, 2005.

Web Link

1. <https://www.researchgate.net/profile/Hazim-Tahir/post/How-can-I-find-the-coefficient-for-fitting-a-curve-in-MATLAB/attachment/59d61dd179197b807797a400/AS%3A273591222898691%401442240638234/download/MATLAB+An+Introduction+with+Ap+-+Amos+Gilat.pdf>
2. <http://www.uop.edu.pk/ocontents/A%20Guide%20to%20MATLAB.pdf>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	22VAM2:1	VEDIC MATHEMATICS						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 (✓)= 33					Relationship: MODERATE						

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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	3	3	3	21	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – III

Course Code: 22PVAMA2:2
 Instruction Hours:
 Credits: 2

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

VALUE ADDED COURSE – II – INTRODUCTION TO LATEX**OBJECTIVES**

- To make the students learn the art of typing mathematics text on their own.
- To inculcate professional training required to become a scholar in mathematics.

COURSE OUTCOMES

At the end of the course, students will be able to:

1. Type their own mathematical article/notes/book/journal paper/project work&Meticulously prepare their own mathematical notes.
2. Understand basic structure of Latex 2e and conversions of them to various formats, Typeset and compile documents with titles, sectioning and enumeration etc.
3. Use various style files and in particular amsmath, amsfonts, amsthm&Understand how to align math equations, matrices etc.
4. Include the figures in various formats into their latex document and compile it• successfully.
5. Utilize bibtex feature of including bibliographies and indexes

UNIT – I

Basic Structure of Latex 2e - Input file structure - Layout-Editors - Forward Search- Inverse Search - Compiling - Conversion to various formats.

UNIT – II

Typesetting simple documents - sectioning –Titles- page layout -listing – enumerating - quote letter formats.

UNIT – III

Usingpackage amsmath typing equations labeling and referring.

UNIT – IV

Figure inclusion - Table inclusion.

UNIT – V

Bibliography - Index typing - Beamer presentation Styles.

REFERENCES:

1. Leslie Lamport. LATEX: A Document Preparation System, Addison-Wesley, Reading, Massachusetts, second edition, 1994.

2. Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl., The (Not So) Short Introduction to LATEX2e, Samurai Media Limited
(or available online at <http://mirrors.ctan.org/info/lshort/english/lshort.pdf>)
3. LATEX Tutorials - A Primer, Indian TeX Users Group, available online at <https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf>
4. H. J. Greenberg. A Simplified introduction to LATEX, available online at <https://www.ctan.org/tex-archive/info/simplified-latex/>
5. Using Kile - KDE Documentation, https://docs.kde.org/trunk4/en/extragear_office/kile/quick-using.html
6. Amsmath and geometry package available in Ctan.org.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	22VAM2:2	INTRODUCTION TO LATEX						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 (✓) = 35 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	0	0	0	21	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** - Global

SEMESTER – IV

Course Code: 22PMA4CC9

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – IX –FUNCTIONAL ANALYSIS**OBJECTIVES:**

- To know the theorems of Functional Analysis viz., Hahn-Banach theorem.
- To analyse the open mapping theorem and Uniform boundedness principle.

COURSE OUTCOMES:

1. Define and illustrate Banach Space and Hahn Banach theorem.
2. State and Prove Fundamental theorem.
3. Define and illustrate Hilbert spaces and orthogonal sets and sequences.
4. Prove Spectral theorem.
5. Gain the knowledge of Banach algebras and Derive the Formula for the Spectral Radius.

UNIT – I

NORMED SPACES: Normed Spaces – Banach Space and further properties – Heine-Borel theorem – Riesz lemma - Continuous linear transformations – Hahn-Banach Theorem and its consequences.

UNIT – II

FUNDAMENTAL THEOREMS: Natural imbedding of N in N^{**} - Uniform boundedness Principle - Open mapping theorem – Closed graph theorem – The Conjugate of an operator.

UNIT – III

HILBERT SPACES: Definition and properties – Orthogonal complements and direct sums - Orthonormal sets and sequences – Series related to orthonormal sets and sequences – Maximal orthonormal sets and sequences – Projection theorem.

UNIT – IV

OPERATORS ON HILBERT SPACES: The adjoint of an operator – self adjoint operator – Normal and Unitary operators – Projections – The spectrum of bounded operator – Spectral theorem for normal and self adjoint operator.

UNIT – V

BANACH ALGEBRAS: Introduction to Banach Algebras - Definition - Examples and some related basic results – Regular and singular elements – Topological divisors of zero – The Spectrum – The formula for the Spectral Radius.

TEXT BOOK:

1. G.F Simmons, Introduction to Topology and Modern Analysis, Tata McGraw Hill, 1963.

UNIT – I	Chapter – 9	Sections 46 to 48
UNIT – II	Chapter – 9	Sections 49 to 51
UNIT – III	Chapter – 10	Sections 52 to 55
UNIT – IV	Chapter – 10	Sections 56 to 59
UNIT – V	Chapter – 12	Sections 64 to 68

REFERENCE(S):

1. Walter Rudin, Functional Analysis, TMH Edition, 1974.
2. Balmohan V. Limaye, Functional Analysis, Second Print, Wiley Eastern Limited, Bombay, 2005.
3. M. Thamban Nair, Functional Analysis, A First Course, Prentice Hall of India, 2002.

Web Link:

1. <https://www.pdfdrive.com/functional-analysis-e188487454.html>
2. <https://www.pdfdrive.com/functional-analysis-e158374735.html>
3. <https://www.pdfdrive.com/functional-analysis-a-first-course-e191416779.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	22PMA4CC9	FUNCTIONAL 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(✓) = 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
30	1	1	1	30	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22PMA4CC10

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE – X – DIFFERENTIAL GEOMETRY**OBJECTIVES:**

- To understand the curvature and torsion of a space curve.
- To know Geodesics and the Non-Intrinsic properties of a surface.

COURSE OUTCOMES:

After successful completion of the course, students will be able to

1. Calculate the curvature and torsion of a curve.
2. Study the concept of local Intrinsic properties of a surface, families of curves and
3. Understand the concept of Isometric correspondence and Study Canonical geodesic equations.
4. Calculate the Gaussian curvature, the mean curvature, the curvature lines, the asymptotic lines, the geodesics of a surface.
5. Analyze the developables associated with curves on surfaces, Minimal surfaces and Ruled surfaces.

UNIT – I

Space Curves: Definition of a space curve - Arc length - Tangent - normal and binormal - curvature and torsion - Contact between curves and surfaces - Tangent surface - Involutives and Evolutes.

UNIT – II

Intrinsic Properties of a Surface: Definition of a surface - Curves on a surface - Surface of revolution - Helicoids - Metric Direction coefficients - Families of curves.

UNIT – III

Intrinsic Properties of a Surface (Continued): Isometric correspondence - Intrinsic properties. **Geodesics:** Geodesics - Canonical geodesic equations - Normal property of geodesics.

UNIT – IV

Geodesics (Continued): Existence Theorems - Geodesic parallels - Geodesics curvature - Gauss Bonnet Theorem - Gaussian curvature - Surface of constant curvature.

UNIT – V

Local Non Intrinsic Properties of a Surface: The second fundamental form - Principal curvature - Lines of curvature - Developables - Developable associated with space curves and with curves on surfaces - Minimal surfaces - Ruled surfaces.

TEXT BOOK:

1. T.J. Willmore, An Introduction to Differential Geometry, Oxford University Press, (17th Impression) New Delhi, 2005. (Indian Print).

UNIT – I	Chapter – 1	Sections 1 to 7
UNIT – II	Chapter – 2	Sections 1 to 7
UNIT – III	Chapter – 2	Sections 8 to 12
UNIT – IV	Chapter – 2	Sections 13 to 18
UNIT – V	Chapter – 3	Sections 1 to 8

REFERENCE(S):

1. Struik, D.T. Lectures on Classical Differential Geometry, Addison - Wesley, Mass. 1950.
2. Kobayashi .S and Nomizu.K, Foundations of Differential Geometry, Interscience Publishers, 1963.
3. WihelmKlingenberg: A course in Differential Geometry, Graduate Texts in Mathematics, Springer Verlag, 1978.

Web Link:

1. <https://www.math.ucla.edu/~petersen/DGnotes.pdf>
2. <https://www.pdfdrive.com/differential-geometry-of-curves-and-surfaces-e183809914.html>
3. <https://www.pdfdrive.com/elementary-differential-geometry-e185499035.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	22PMA4CC10	DIFFERENTIAL GEOMETRY					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(✓) = 38 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
32	0	0	0	32	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22PMA4IBC
 Instruction Hours: 6
 Credits: 4

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

INDUSTRY BASED COURSE – I – OPTIMIZATION TECHNIQUES**OBJECTIVES:**

- To use integer programming problem to solve system of linear equations.
- To provide the depth knowledge about inventory control theory and make students to solve the inventory problems

COURSEOUTCOMES:

1. Describe Integer Linear Programming and Gomory's all integer cutting plane method.
2. The learner will befall skillful in decision making, markov process, integer programming, enumeration algorithm, dynamic programming, Stage coach and cargo leading problem.
3. Acquire essential concepts in nonlinear programming.
4. Explain EOQ, EOQ with Price Breaks and Inventory Problems with Uncertain Demand.
5. Understand the concept of queuing theory and its Characteristics.

UNIT – I

INTEGER PROGRAMMING: Introduction – Integer Programming Formulations – Gomory's construction–The Cutting Plane Algorithm - Fractional cut method (all integer) – Branch and Bound Technique – Zero One Implicit Enumeration Algorithm.

UNIT – II

DYNAMIC PROGRAMMING: Introduction– Application of Dynamic Programming -Capital Budgeting Problem – Reliability Improvement Problem – Stage-coach Problem – Cargo Leading Problem – Minimizing Total Tardiness in Single Machine Scheduling Problem.

UNIT – III

NON LINEAR PROGRAMMING Introduction– Lagrangean Method–Jacobi method - Kuhn–Tucker Method – Quadratic Programming – Separable Programming – Chance–Constrained Programming or Stochastic Programming.

UNIT – IV

INVENTORY: Introduction – Reason for carrying inventories–Types of Inventories –Inventory Decisions –Objectives of Scientific inventory control- Cost Associated with Inventories – Factors Affecting inventory control – Economic Order Quantity – Deterministic Inventory Problems with No Shortages – Deterministic inventory Models with shortages – EOQ with Price Breaks – Multi Item Deterministic problems –Inventory Problems with Uncertain Demand

UNIT – V

QUEUING THEORY: Introduction – Queuing System – Elements Of Queuing System – Operating Characteristics of Queuing System – Classification of Queuing Models – Model– I(M/M/1):(∞/FIFO), Model – II(M/M/1) : (N/FIFO), Model–III (M/M/C):(∞/FIFO), Model – IV(M/M/C):(N/FIFO) - Problems in above four models.

TEXT BOOK:

1. KantiSwarup, P.K. Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, Educational Publishers, New Delhi.
2. Panneerselvam.R, Operations Research, 2nd Edition, PHI Learning Private Limited, Delhi, 2015

UNIT – I	Chapter – 6	Sections 6.1 to 6.5 of [2]
UNIT – II	Chapter – 8	Sections 8.1 to 8.2.7 of [2]
UNIT – III	Chapter – 17	Sections 17.1 to 17.6 of [2]
UNIT – IV	Chapter – 19	Sections 19.1 to 19.13 of [1]
UNIT – V	Chapter – 21	Sections 21.1 to 21.4, 21.7, 21.9 of [1]

REFERENCE BOOK(S):

1. Hamdy A. Taha, Operations Research,(sixth edition)Prentice–Hall of India private Limited ,New Delhi,1997.
2. Hiller.F.S&Lieberman.J Introduction to Operation Research,7th Edition, Tata– MCGraw Hill Publishing Company, NewDelhi, 2001.
3. Prem Kumar Gupta.Er, Hira.D.S. Operations Research,7thEdition,S.Chand& Company Pvt.Ltd.2014.

Web Link:

1. <https://www.pdfdrive.com/operations-research-an-introduction-e33409273.html>
2. <https://www.pdfdrive.com/introduction-to-operations-research-e14995994.html>
3. <https://www.pdfdrive.com/operations-research-e176219303.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	22PMA4IBC	OPTIMIZATION TECHNIQUES					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(✓) = 39						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
44	1	1	1	44	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22PMA4NME2:1

Instruction Hours: 3

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

NON - MAJOR ELECTIVE – II – ANALYTICAL REASONING&MENTAL ABILITY

OBJECTIVES

- To comprehend complex ideas, solve problems, and apply learned skills through questions based on abstract reasoning, numeric reasoning, and verbal reasoning.
- To develop the thinking capacity.

COURSE OUTCOMES

1. Understand the concept of coding and decoding test.
2. Solve the problems based on blood relations.
3. Illustrate the concept of direction sense test.
4. Finding the problems of logical diagram.
5. Identify the short cuts of finding the missing one.

UNIT I

Coding Decoding Test.

UNIT II

Blood Relation.

UNIT III

Direction sense Test

UNIT IV

Logical Venn Diagram.

UNIT V

Inserting the missing one

TEXT BOOK:

1. R.V.Praveen, Quantitative Aptitude and Reasoning, Phi Learning, New Delhi, 2nd Edition-2013.
Part – II Reasoning (Section – A)

UNIT – I Chapter –4

UNIT – II Chapters – 5

UNIT – III Chapters – 7

UNIT – IV Chapters – 8

UNIT – V Chapters –14

Web Link

1. <https://3.imimg.com/data3/GR/OF/MY-1056081/quantitative-aptitude-and-reasoning.pdf>
2. <https://www.youtube.com/watch?v=Z3V2m7gtiLg>
3. <https://www.indiabix.com/non-verbal-reasoning/analytical-reasoning/>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
IV	22PMA2NME2:1	ANALYTICAL REASONING & MENTAL ABILITY					3	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 (✓) = 36						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

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

Topics					
5	0	0	0	5	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – IV

Course Code: 22PMA4NME2:2

Exam Hours: 3

Instruction Hours: 3

Internal Marks: 25

Credits: 2

External Marks: 75

NON - MAJOR ELECTIVE – II – SAGEMATH

OBJECTIVES

- To "create a viable free open source alternative to Magma, Maple, Mathematica and Matlab.
- SageMath is built upon open-source software and it is fully open-source by itself. It is free to use worldwide for private, commercial, governmental, etc..

COURSE OUTCOMES

1. Using SageMath as a calculator.
2. Implement and illustrate 2-D graphs and 3-D graphs.
3. Solving mathematical problems and to plot using SageMath.
4. Implement SageMath using templates and exceptional and handling concepts.
5. Make use of theoretical concepts to solve problems and visualize the output.

List of Practical

1. Finding all local extrema and inflection points of a function.
2. Creating and plotting 2-D graphs and 3-D graphs.
3. Finding the surface area of given surface using package.
4. Finding the approximate roots using Newton's method.
5. Plotting and finding area between curves using integrals.

6. Finding the average of a function.
7. Finding the volume of solid of revolution.
8. Finding the solution for a system of linear equations.
9. Finding the divergence and curl of vector valued functions.
10. Using differential calculus to analyse a quintic polynomials features, for finding the optimal graphing window.

Books for Reference:

1. Razvan A. Mezei, An Introduction to SAGE Programming: With Applications to SAGE, Wiley, 2016
2. <https://doc.sagemath.org/pdf/en/tutorial/SageTutorial.pdf>

Web Link

1. <https://www.perlego.com/book/996725/an-introduction-to-sage-programming-with-applications-to-sage-interacts-for-numerical-methods-pdf>
2. <https://www.pdfdrive.com/an-introduction-to-sage-programming-with-applications-to-sage-interacts-for-mathematics-d188174981.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
IV	22PMA2NME2:2	SAGEMATH					3	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 (✓) = 36						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
10	0	0	0	10	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

M.Phil MATHEMATICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2022 - 2023 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)



THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B⁺⁺)

(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 scholar will be able to

1. Adopt self-learning through reviews of previously acquired knowledge
2. Implement research by focusing on newer thrust areas of knowledge
3. Engage in quality and efficient designing, implementing and evaluating of the gathered information
4. Demonstrate technical and analytical competence with local and global perspective
5. Have professional integrity with knowledge of appropriate code of ethics and standards displaying social responsibilities

Program Specific Outcomes(PSOs)

1. Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
2. Nurture problem solving skills, thinking, creativity through assignments, project work.
3. Inculcate mathematical reasoning.
4. Prepare and motivate students for research studies in mathematics and related fields.
5. Provide advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.



Thanthai Hans Roever College (Autonomous)
Perambalur- 621220

M.Phil.Mathematics Courses structure Under CBCS Pattern 2022

Semester	Course Code	Course	Course Title	No. of Hours	Credit	CIA Marks	SE Marks	Total Marks
I	22MPMA1CC1	Core-I	Research Methodology	6	4	25	75	100
	22MPMA1CC2	Core-II	Analysis and Applied Mathematics	6	4	25	75	100
	22MPMA1CC3	Core-III	Teaching and Learning Skills	6	4	25	75	100
	22MPMA1CC4	Core-IV	Paper on Topic on Research (To be Framed by the Guide)	6	4	25	75	100
Total				24	16	100	300	400
II	22MPMA2DW	Project Work	Dissertation	-	8	-	-	200
Total				-	24	-	-	600

- One Hour Library for each Course.
- Evaluation of the Dissertation shall be made jointly by the Research Supervisor and External Examiner.

PROJECT:

Maximum Marks : 200

Evaluation of Project : 150 Marks

Viva Voce :50 Marks

SEMESTER – I

Course Code: 22MPMA1CC1

Exam Hours: 3

Instruction Hours:6

Internal Marks: 25

Credits: 4

External Marks: 75

CORE-I - RESEARCH METHODOLOGY**OBJECTIVES:**

- Analyze the structure of real world problems and plan solution strategies to solve the problems using appropriate tools
- To understand the various aspects of Research.

COURSE OUTCOMES:

1. Demonstrate and analyze creatively to propose research problem of research design.
2. Analyze the concept of Noetherian modules, Primary decomposition and Artinian modules
3. Apply domain knowledge of topological preliminaries and regularity properties of Borel measures.
4. Transcribe and concentrate on a total variation, Consequences of the Random Nikodym theorem and Riesz representation Theorem.
5. Adopt the results of the Fundamental group and Covering spaces

UNIT – I

Research Methodology: An introduction– Defining the research problem– Research design - Research Ethics.

UNIT –II

Noetherian modules – Primary decomposition – Artinian modules

UNIT -III

Real Analysis: Vector spaces – Integration as linear functional - Topological preliminaries – Regularity properties of Borel measures.

UNIT – IV

Complex Measures: Total variation – Absolute – Continuity - Consequences of the Random Nikodym theorem - Bounded linear functional of L^p - Riesz representation Theorem.

UNIT – V

Topology: The Tychonoff theorem – The stone_ceil Compactification - Homotopy of paths – The Fundamental group – Covering spaces- The Fundamental Group of the Circle.

TEXT BOOK(S):

1. C.R.Kothari, Research Methodology, New Age International Publishers, Second Revised Edition Reprint (2009).
2. N. S. Gopalakrishnan, Commutative Algebra, Oxonian Press Private Ltd, New Delhi, Second Edition(1988).
3. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Company Limited, Third Edition (2006).
4. James R. Munkres, Topology a First Course, Prentice Hall of India Learning Private Ltd. (2009).

UNIT – I Chapters–1, 2 & 3 Page No. 1 to 54 of [1]

UNIT – II Chapter – 3 Sections 3.1 to 3.3 of [2]

UNIT – III Chapter – 2 Sections 2.1 to 2.13, 2.15 to 2.18 of [3]

UNIT – IV Chapter – 6 Sections 6.1 to 6.19 of [3]

UNIT – V Chapter – 9 Sections 51 to 54 of [4]

REFERENCE(S):

1. David S. Dummit and Richard M. Foote, Abstract Algebra, Wiley-Student Edition, India, Second Edition (2009).

2. G. De. Barra, Measure Theory and Integration, New Age International (P) Ltd., NewDelhi, Reprint(2009).
3. P. R. Halmos, Measure Theory, D. Van Nostrand Company Inc, Princeton N.J. (1950).
4. Serge Lang, Algebra, Addition- Wesley Publishing Company, Sydney, London, SecondEdition (1970).
5. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, Second Edition(2002).

Web Link:

1. <https://www.pdfdrive.com/abstract-algebra-3rd-edition-e161809852.html>
2. <https://www.pdfdrive.com/measure-theory-and-integration-e183696899.html>
3. <https://www.pdfdrive.com/measure-theory-graduate-texts-in-mathematics-e3076860.html>
4. <https://www.pdfdrive.com/serge-lang-introduction-to-linear-algebra-second-edition-e33405353.html>
5. <https://www.pdfdrive.com/mathematical-analysis-e184071294.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22MPMA1CC1	RESEARCH METHODOLOGY					6	4			
Course Outcomes (COs)	ProgrammeOutcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓		✓	✓	✓		✓	✓	
CO3		✓	✓	✓		✓		✓	✓		
CO4	✓	✓		✓	✓		✓	✓		✓	
CO5	✓	✓	✓		✓	✓	✓		✓	✓	
Number of Matches(✓) = 38						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
23	0	0	0	23	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

SEMESTER – I

Course Code: 22MPMA1CC2

Exam Hours: 3

Instruction Hours:6

Internal Marks: 25

Credits: 4

External Marks: 75

CORE-II – ANALYSIS AND APPLIED MATHEMATICS**OBJECTIVES:**

- To know the definitions and understand the key concepts introduced in this modules.
- To understand a thorough knowledge of the various aspects of Real line which is imperative for any advanced Learning in Pure Mathematics.

COURSE OBJECTIVES:

1. Examine the Gelfand mapping theorem and Gelfand – Neumark theorem
2. Analyze and distinguish the concepts of Linear and Non-Linear systems of Differential Equations.
3. Determine the domain knowledge on the domination number of graph,
4. To gain the Knowledge of Wavelets on Z_N .
5. Illustrate and acquire the knowledge of the Fuzzy Graph:

UNIT – I

Functional Analysis:General preliminaries on Banach Algebras- The definition and some Examples – Regular and singular elements – Topological divisors of zero- The Spectrum – The

Formula for the spectral radius – the radial and semi simplicity- The structure of commutative Banach Algebra -The Gelfand mapping – Application of the formula $\rho(x) = \lim || x^n ||^{1/n}$ - Involution in Banach Algebra - The GelfandNeumark theorem.

UNIT – II

Differential Equation (Linear and Non-Linear systems):Uncoupled linear systems – Diagonalization – Exponential of operators – The fundamental theorem for linear systems – linear system in R^2 – Complex Eigen values - Multiple Eigen Values - Some preliminary concepts and definitions – The fundamental existence – Uniqueness theorem.

UNIT – III

Graph Theory:Introduction - Domination in Graphs - Bounds for the Domination Number - Bound for the Size m in Terms of Order n and Domination Number $\gamma(G)$ - Independent Domination and Irredundance

UNIT – IV

Wavelets on Z_N :Construction of wavelets on Z_N in First Stage - Construction of wavelets on Z_N :The Iteration step - Examples and Applications

UNIT – V

Fuzzy Graph: Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees.

TEXTBOOK(S):

1. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill International
2. L.Perko, Differential Equations and Dynamical Systems, Third Edition, Springer International Edition, (2009).
3. R.Balakrishnan&K.Ranganathan, A text Book of Graph Theory, Second Edition, Springer Science + Business Media, New York 2012.
4. Michael W. Frazier An Introduction to Wavelets through Linear Algebra, Springer,1999.
5. A. NagoorGani and V. T. Chandrasekaran, A first look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd. Chennai, First Edition (2010).

UNIT – I Chapters– 12& 13 Sections 64 to 69 &70 to 73 of [1]

UNIT – II Chapters–1 & 2 Sections 1.1 to 1.7 & 2.1 to 2.2 [2]

UNIT – III Chapter– 10 Sections 10.1 to 10.5 of [3]

UNIT – IV Chapter – 3 Section 3.1, 3.2, 3.3

UNIT – V Chapter –3 Sections 3.1 to 3.3 [5]

REFERENCE(S):

1. Balmohan V Limaye, Functional Analysis, New Age International(P)Ltd.NewDelhi, SecondEdition (2009).
2. M.Murugan, Topics in Graph Theory and Algorithms, Muthali Publishing House, Annanagar, Chennai, First Edition (2003).

Web Link:

1. <https://www.pdfdrive.com/functional-analysis-e158374735.html>
2. <https://www.pdfdrive.com/introduction-to-topology-and-modern-analysis-e176226233.html>
3. <https://www.pdfdrive.com/an-introduction-to-wavelets-through-linear-algebra-e175815585.html>
4. <https://www.pdfdrive.com/fuzzy-sets-and-fuzzy-logic-e33448886.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	22MPMA1CC2	ANALYSIS AND APPLIED MATHEMATICS					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: 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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
33	3	3	3	33	Global

Green - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

SEMESTER – I

Course Code: 22MPMA1CC3
 Instruction Hours:6
 Credits: 4

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

CORE-III – TEACHING LEARNING SKILLS**OBJECTIVES:**

- Understand the communication process through the web.
- Acquire the knowledge of Instructional Technology and its Applications.

COURSEOUTCOMES:

1. Develop skills of ICT and apply them in teaching learning context and Research and Appreciate the role of ICT in teaching, learning and Research.
2. Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
3. Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject and the communication process through the web.
4. Acquire the knowledge of Instructional Technology and its Applications.
5. Develop different teaching skills for putting the content across to targeted audience.

UNIT-I: Computer Application Skills

Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, spread sheets, Power point slides in the classroom.

ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations

ICT for Professional Development: Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

Unit II: Communications Skills

Communication: Definitions - Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise

Types of Communication: Spoken and Written; Non-verbal communication– Intrapersonal, interpersonal, Group and Mass communication

Barriers to communication: Mechanical, Physical, Linguistic & Cultural

Skills of communication: Listening, Speaking, Reading and Writing– Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary– Classroom communication and dynamics.

Unit III: Pedagogy

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction– Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation- Versatility of Lecture technique

Demonstration: Characteristics, Principles, planning Implementation and Evaluation – **Teaching-learning Techniques:** Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

Unit IV: E- Learning, Technology Integration and Academic Resources in India

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching learning processes; frameworks guiding technology integration (likeTPACK; SAMR); Technology Integration Matrix- Academic Resources inIndia:MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-SodhSindhu; virtual labs;eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

Unit V: Skills of Teaching and Technology based assessment

Teaching skills:Definition, Meaning and Nature - Types of Teaching Skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills-

Technology for Assessment: Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; erubrics, etc.); online assessment (open-source software's; e-portfolio; quiz makers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

References

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods,Sarup and sons, New Delhi
2. Brandon Hall , E-learning, A research note by Namahn, foundin: www.namahn.com/resources/.../note-e-learning.pdf, Retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd.,Edinburgh
4. Information and Communication Technology in Education: A Curriculumfor schools and programmed of Teacher Development, Jonathan Andersonand Tom Van Weart, UNESCO, 2002.
5. Jereb, E., &Šmitek, B. (2006). Applying multimedia instruction in elearning.Innovations in Education & Teaching International, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, New Age InternationalPublishers, New Delhi.
7. Learning Management system: https://en.wikipedia.org/wiki/Learning_management_system,Retrievedon 05/01/2016
8. Mangal, S.K (2002) Essential of Teaching – Learning and InformationTechnology, Tandon Publications, Ludhiana.
9. Michael,D and William (2000), Integrating Technology into Teaching andLearning: Concepts and Applications, Prentice Hall, New york.8
10. Pandey,S.K (2005) Teaching communication, Commonwealth Publishers,New Delhi.
11. Ram Babu,AabdDandapani,S (2006), Microteaching (Vol.1 & 2),Neelkamal Publications, Hyderabad.
12. Singh,V.K and Sudarshan K.N. (1996), Computer Education, DiscoveryPublishing Company, New York.

13. Sharma,R.A., (2006) Fundamentals of Educational Technology, SuryaPublications,Meerut

14. Vanaja,M and Rajasekar,S (2006), Computer Education, NeelkamalPublications, Hyderabad.

Web Link

1. <https://www.pdfdrive.com/learning-teaching-the-essential-guide-to-english-language-teaching-e188299714.html>
2. <https://www.pdfdrive.com/mechanics-part-1-dc-pandey-e37199444.html>
3. <https://www.pdfdrive.com/a-handbook-for-curriculum-development-and-teacher-training-e43479887.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22MPMA1CC3	TEACHING LEARNING SKILLS					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(✓) =38						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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
33	0	0	0	33	Global

SEMESTER – I

Course Code: 22MPMA1CC4

Instruction Hours:6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE IV: OPERATIONS RESEARCH**OBJECTIVES:**

- To acquire the knowledge of goal programming, decision theory & games
- To provide the depth knowledge about Inventory & Queuing models

COURSEOUTCOMES:

1. The learner will be fall skillful in Solution of Linear programs by Dynamic programming.
2. Acquire essential concepts in Decision Theory and Games.
3. Demonstrate Inventory Models and Just-in-Time (JIT) manufacturing system.
4. Understand the concept of queuing theory and its Characteristics.
5. Acquire essential concepts in nonlinear programming

UNIT –I:**GoalProgramming:**

A Goal Programming Formulation-Goal Programming Algorithms.

UNIT II: Decision Theory and Games

Decisions under Risk- Decision Tree - Decisions Under Uncertainty - Game Theory.

UNIT III: Inventory Models

The ABC Inventory System- Generalized Inventory Models– Deterministic Models – Just in Time (JIT) manufacturing system.

UNIT IV: Queuing Models

Role of Poisson and Exponential Distribution- Processes Birth and Fousson and Death- Queues with Combined Arrival and Departures - Non-Poisson Queues - Queues with Priorities for Service - Random or Series Queues.

UNIT V: Nonlinear Programming

UnconstrainedExtremal Problems -ConstrainedExtremal Problems- Nonlinear Programming Algorithm- Unconstrained Nonlinear Algorithms - Constrained Nonlinear Algorithms.

Text Book:

1. Operations Research - An Introduction (Eight Edition - 2011) H.A.Taha, Prentice Hall of India (P) Limited, New Delhi,

UNIT – I	Chapter – 8
UNIT – II	Chapter – 13
UNIT – III	Chapter – 14
UNIT – IV	Chapter – 15
UNIT – V	Chapter – 19

Reference Books:

1. D. Phillips, A. Ravindran, Solberg, Operations Research: Principals and Practice, JOHN WILEY & SONS (1976).

2. S.S.Rao, Engineering Optimization, (3rd Edition, 1996), New Age International (p) Ltd, New Delhi - 110 002

Web Link

1. <https://www.pdfdrive.com/operations-research-e32659111.html>
2. <https://www.pdfdrive.com/operations-research-and-management-science-handbook-the-operations-research-series-e164947777.html>
3. <https://www.pdfdrive.com/engineering-optimization-theory-and-practice-fourth-edition-e17279363.html>
4. <https://www.pdfdrive.com/operation-research-books.html>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	22MPMA1CC4	OPERATIONS RESEARCH					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: 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

Total Number of Topics	Number of Topics				Category Based on %
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21	2	2	2	21	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

