B.Sc MATHEMATICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 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 multifaceted 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.
- 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 2020 -2021 onwards)

Semester	Part	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
1	I	20UT1	Tamil - I (IkkalaIlakkiyam - Kavithai, Sirukathai, Urainadai, IlakkiyaVaralaru)	6	3	3	25	75	100
1	II	20UE1	English - I (Communicative English-I)	6	3	3	25	75	100
1	III	20UMA1CC1	Algebra and Theory of Numbers	6	5	3	25	75	100
1	III	20UPH1AC1	Physics – I (Properties of Matter, Thermal Physics and Optics)	5	3	3	25	75	100
1	III	20UPH2AP1	Physics – II (Practical)	3	-	-	-	-	-
1	III	20UMA1PE1	Professional English for Physical Sciences - I	2	2	3	25	75	100
1	IV	20UVE	Value Education	2	2	3	25	75	100
			Total	**30**	**18**	**-**	**-**	**-**	**600**
2	I	20UT2	Tamil - II (IdaikkalaIlakkiyam - Bakthi, Puthinam, IlakkiyaVaralaru)	6	3	3	25	75	100
2	II	20UE2	English – II (Communicative English-II)	6	3	3	25	75	100
2	III	20UMA2CC2	Differential Calculus	4	4	3	25	75	100
2	III	20UMA2CC3	Analytical Geometry (3D) and Trigonometry	4	4	3	25	75	100
2	III	20UPH2AP1	Physics – II (Practical)	2	3	3	40	60	100
2	III	20UPH2AC2	Physics – III (Electricity, Electronics, Atomic and Nuclear Physics)	4	2	3	25	75	100
2	III	20UMA2PE2	Professional English for Physical Sciences - II	2	2	3	25	75	100
2	IV	20UES	Environmental Studies	2	2	3	25	75	100
			Total	**30**	**24**	**-**	**-**	**-**	**800**
3	I	20UT3	Tamil-III (KappiyaIlakkiyam, Nadagam, IlakkiyaVaralaru)	6	3	3	25	75	100
3	II	20UE3	English-III (Language Through Literature and Communicative Skills – I)	6	3	3	25	75	100
3	III	20UMA3CC4	Integral Calculus	5	5	3	25	75	100
3	III	20UMA3CC5	Differential Equations	5	4	3	25	75	100
3	III	20UMA3AC3	Mathematical Statistics - I	4	4	3	25	75	100
3	IV	20UMA4AP2	Mathematical Statistics (Practical)	2	-	-	-	-	-
3	IV	NME1		2	2	3	25	75	100
			Total	**30**	**21**	**-**	**-**	**-**	**600**

4	I	20UT4	Tamil-IV (PazhanthamizhIlakkiyam, IlakkiyaVaralaru&Pothukkatturai)	6	3	3	25	75	100
4	II	20UE4	English –IV(Language Through Literature and Communicative Skills – II)	6	3	3	25	75	100
4	III	20UMA4CC6	Laplace Transforms and Fourier Transforms	4	4	3	25	75	100
4	III	20UMA4CC7	Vector Calculus and Fourier Series	4	4	3	25	75	100
4	III	20UMA4AC4	Mathematical Statistics - II	4	4	3	25	75	100
4	III	20UMA4AP2	Mathematical Statistics (Practical)	2	3	3	40	60	100
4	IV	NME2		2	2	3	25	75	100
4	IV	20UMA4SBE1	Mathematics for Competitive Examinations - I	2	2	3	25	75	100
			Total	**30**	**25**	**-**	**-**	**-**	**800**
5	III	20UMA5CC8	Algebra	5	5	3	25	75	100
5	III	20UMA5CC9	Real Analysis	5	5	3	25	75	100
5	III	20UMA5CC10	Statics	5	4	3	25	75	100
5	III	20UMA5CC11	Programming in C	5	4	3	25	75	100
5	III	20UMA5MBE1:1 20UMA5MBE1:2	Numerical Methods Discrete Mathematics	4	4	3	25	75	100
5	IV	20UMA5SBE2	Mathematics for Competitive Examinations - II	2	2	3	25	75	100
5	IV	20UMA5SBE3	MATLAB Applications	2	2	3	25	75	100
5	IV	20USSD	Soft Skill Development	2	2	3	25	75	100
			Total	**30**	**27**	**-**	**-**	**-**	**800**
6	III	20UMA6CC12	Linear Algebra	5	5	3	25	75	100
6	III	20UMA6CC13	Complex Analysis	6	5	3	25	75	100
6	III	20UMA6CC14	Dynamics	5	4	3	25	75	100
6	III	20UMA6MBE2:1 20UMA6MBE2:2	Operations Research Astronomy	5	3	3	25	75	100
6	III	20UMA6MBE3:1 20UMA6MBE3:2	Graph Theory Number Theory	5	3	3	25	75	100
6	III	20UMA6CP1	Programming in C (Practical)	3	3	3	40	60	100
6	V	20UGS	Gender Studies	1	1	3	25	75	100
6	V		Extension Activities	-	1	-	-	-	-
			Total	**30**	**25**	**-**	**-**	**-**	**700**
			Grand Total	**180**	**140**				**4300**

List of Allied Courses

Group I (Any one)	**Group II (Any one)**
1. Physics	1. Mathematical Statistics
2. Computer Science	2. Chemistry
3. Financial Accounting	3. Management Accounting

Paper Details:

Tamil Paper - Part I	- 4
English Paper - Part II	- 4
Core Course Paper	- 14
Core Course Practical	- 1
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
Professional English	- 2
Soft Skill Development	- 1
Gender Studies	- 1
Extension Activities	- 1 (Credit Only)

- For those who studied Tamil up to 10th +2 (Regular Stream)
- Syllabus for other Languages should be on par with Tamil at degree level
- Those who studied Tamil up to 10th +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV
- Extension Activities shall be outside instruction hours

Non Major Elective I & II – for those who studied Tamil under Part- I

Basic Tamil I & II for other language students

Special Tamil I & II for those who studied Tamil up to 10th or +2 but opt for other languages in degree programme.

Note:

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60

3. Separate passing minimum is prescribed for Internal and External marks

NME Papers offered to Other Department

20UMA3NME1 - Mathematics for Competitive Examinations – I

20UMA4NME2 -Mathematics for Competitive Examinations – II

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]

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)

SEMESTER – I

Course Code: 20UMA1CC1 Exam Hours: 3

Instruction Hours: 6 Internal Marks: 25

Credits: 5 External Marks: 75

CORE COURSE – I –ALGEBRA AND THEORY OF NUMBERS

Course Outcomes:

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

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

UNIT – I

Inequalities-Triangle Inequalities –Arithmetic Mean–GeometricMeanandHarmonic means -Cauchy's Schwarz Inequality

UNIT – II

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

UNIT – III

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

UNIT – IV

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

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 – Highest power 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 2.3 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]
UNIT – V	Chapter – 5	Sections 1 to 10 of [3]

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20UMA1CC1		ALGEBRA AND THEORY OF NUMBERS			6			5	
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**	
25	**0**	**0**	**0**	**25**	**Global**

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

SEMESTER – I

Course Code: 20UMA1PE1 Exam Hours: 3
Instruction Hours: 2 Internal Marks: 25
Credit: 2 External Marks: 75

PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES – I

COURSE OUTCOMES:

- Recognise their own ability to improve their own competence in using the language
- Use language for speaking with confidence in an intelligible and acceptable manner
- Understand the importance of reading for life
- Read independently unfamiliar texts with comprehension
- Understand the importance of writing in academic life
  (Outcomes based on guidelines in UGC LOCF – Generic Elective)

NB: All four skills are taught based on texts/passages.

UNIT 1: COMMUNICATION

1. Listening: Listening to instructions
2. Speaking: Telephone etiquette and Official phone conversations
3. Reading short passages (3 passages, one from each – Physics, Chemistry, Mathematics/Computer Science)
4. Writing: Letters and Emails in professional context
5. Grammar in Context:
   - Wh and yes or no,
   - Q tags
   - Imperatives

6, Vocabulary in Context: Word formation - .

i) Creating antonyms using Prefixes
ii) Intensifying prefixes (E. g inflammable)

Changing words using suffixes
A) Noun Endings
B) Adjective Endings
C) Verb Endings

UNIT 2: DESCRIPTION

Listening – Listening to process description
Speaking - Role play
Formal: With faculty and mentors in academic environment, workplace communication
Informal: With peers in academic environment, workplace communication
Reading –Reading passages on products, equipment and gadgets
Writing – Writing sentence definitions (e.g. computer) and extended definitions (e.g. artificial intelligence)
Picture Description – Description of Natural Phenomena
Grammar in Context: Connectives and linkers.
Vocabulary – Synonyms (register) - Compare & contrast expressions.

UNIT 3: NEGOTIATION STRATEGIES

Listening - Listening to interviews of specialists / inventors in fields (Subject specific)
Speaking – Brainstorming. (mind mapping). Small group discussions (subject-specific)
Reading – longer Reading text. (Comprehensive passages)
Writing – Essay Writing (250 word essay on topics related to subject area, like pollution, use of pesticides in cultivation, merits and demerits of devices like mobile phones, merits and demerits of technology in development)
Grammar in Context: Active voice & Passive voice – If conditional - Collocations –Phrasal verbs

UNIT 4: PRESENTATION SKILLS

Listening - Listening to presentation. Listening to lectures. Watching –documentaries (discovery / history channel)
Speaking –Short speech
- Making formal presentations (PPT)
Reading – Reading a written speech by eminent personalities in the relevant field /Short poems / Short biography.
Writing - Writing Recommendations
Interpreting visuals - charts / tables/flow diagrams/charts
Grammar in Context – Modals
Vocabulary (register) - Single word substitution

UNIT 5: CRITICAL THINKING SKILLS

Listening - Listening to advertisements/news and brief documentary films (with subtitles)
Speaking – Simple problems and suggesting solutions.
Reading: Motivational stories on Professional Competence, Professional Ethics and Life Skills (subject-specific)
Writing Studying problem and finding solutions- (Essay in 200 words)
Grammar-Make simple sentences
Vocabulary -Fixed expressions

SUGGESTED ACTIVITIES

UNIT 1

Listening: Links for formal conversation can be given - Gap filling exercises – Multiple Choice questions – Making notes.
Speaking - Role play activity
Reading – Note making. Note-Taking.
Writing: Guided Writing (developing hints)
Email
Grammar: Vocabulary – Worksheets – Games.

UNIT 2

Listening-
Process Descriptions (Processes of Condensation and Evaporation./Process of Measuring the thickness of a wire using a Screw -Gauge./process of Exaction of sugar from sugarcane)
Speaking – Role Play
Reading – Multiple choice questions - Evaluative answers – Classifying and labeling
Writing - Picture description – Description of natural phenomena (rainbow, earthquake, volcanic eruption, erosion, natural disasters in 150 to 200 words).
Vocabulary: Expansion of compound nouns

UNIT 3

Listening- Gap fill exercises – Listening comprehension
Speaking -Debates
Reading -Reading comprehension
Writing – Essay Writing

Grammar - Vocabulary, Activities, Worksheets & Games.

UNIT 4

Listening - Note taking (of listening & viewing items) - Filling a table based on the listening item.
Speaking – JAM, Presentations. (PPT-TECHNICAL)
Reading-Reading comprehension
Writing– Difference between recommendations and instructions
Questions/MCQs based on graphs/flow diagrams/charts
Grammar: Vocabulary – Activities, Worksheets & Games.

UNIT 5

Listening – Radio News/ TV-News telecast /
Speaking - Watch or listen to documentaries and ask questions
Reading - Reading motivational stories (success stories in subject area)
Writing - Essay writing.
Grammar -Vocabulary –Activities, Worksheets & Games

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20UMA1PE1		PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES - I			2			2	
Course Outcomes (Cos)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (POs)**				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓			✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓		✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) = 46 Relationship:**VERY 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 Present in the course: 56

Total Number of Topics	**Number of Topics**				**Category Based on %**
	Local	**Regional**	**National**	**Global**	
56	**15**	**9**	**18**	**14**	**National**

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

SEMESTER – II

Course Code: 20UMA2CC2 Exam Hours: 3
Instruction Hours: 4 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE – III –DIFFERENTIAL CALCULUS

Course Outcomes:

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

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

UNIT – I

Curvature –Radius of curvature in Cartesian and Polar Coordinates – Centre of Curvature – Evolutes and Involutes -Pedal Equation.

UNIT – II

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

UNIT – III

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

UNIT – IV

Tracing of curves: Tracing of curves – Polar Equation- well known curvesCycloid -Epicycloid – Hypocycloid.

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.ManicavachagamPillai, “Differential Calculus”, Volume- I, S.V.Publications, 2004.
2. Dr.P.R.vittal&Dr.V.Malini. “Calculus”, Margham Publications.

UNIT – I	Chapter – 10	Sections 2.1 to 2.8 of [1]
UNIT – II	Chapter – 11	Sections 1 to 7 of [1]
UNIT – III	Chapter – 12	Sections 1 to 7 of [1]
UNIT – IV	Chapter – 13	Sections 1 to 3 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. A. Singaravelu, "Differential Calculus and Trigonometry", AR Publications,2003.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
II	20UMA2CC2		DIFFERENTIAL CALCULUS			4			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**	
25	**0**	**0**	**0**	**25**	**Global**

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

SEMESTER – II

Course Code: 20UMA2CC3 Exam Hours: 3

Instruction Hours: 4 Internal Marks: 25

Credits: 4 External Marks: 75

CORE COURSE – II- ANALYTICAL GEOMETRY – 3D AND TRIGONOMETRY

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, cosnx, tannx*and powers of sines and cosines interms 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: Tangent plane – Circle of intersections – Tangency of sphere – Coaxial system of spheres – Radical plane – Orthogonal sphere.

UNIT – III

Cone and Cylinder: Equation of a cone – Cone with vertex at the origin – Quadric cone with thevertex 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. ManichavasagamPillai, “Trigonometry”, S. Viswanathan (Printers& Publishers, Pvt Limited, 2010.

UNIT – I Chapter – 3 of [1]

UNIT – II Chapter – 5 of [1]

UNIT – III Chapter – 6 of [1]

UNIT – IV Chapter – 3 Section 1 to 5 of [2]
UNIT – V Chapter – 4 Section1 to 2 of [2]

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
II	20UMA2CC3		ANALYTICAL GEOMETRY – 3D AND TRIGONOMETRY			4		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**	
21	**0**	**0**	**0**	**21**	**Global**

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

SEMESTER – II

Course Code: 20UMA2PE2 Exam Hours: 3
Instruction Hours: 2 Internal Marks: 25
Credit: 2 External Marks: 75

PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES – II

Course Outcomes

At the end of the course, learners will be able to,

- Attendinterviewswithboldnessandconfidence.
- Adapt easily into the workplace context, having become communicativelycompetent.
- Apply to the Research &Development organisations/ sections in companiesandofficeswithwinningproposals.
- Learn the writing skills.
- Understanding the writing skills.

UNIT I- Communicative Competence (18 hrs)

Listening – Listening to two talks/lectures by specialists on selected subject specific topics -(TED Talks) and answering comprehension exercises (inferential questions)
Speaking: Small group discussions (the discussions could be based on the listening and reading passages- open ended questions
Reading: Two subject-based reading texts followed by comprehension activities/exercises
Writing: Summary writing based on the reading passages.
Grammar and vocabulary exercises/tasks to be designed based on the discourse patterns of the listening and reading texts in the book. This is applicable for all the units.

UNIT II - Persuasive Communication (18 hrs)

Listening: listening to a product launch- sensitizing learners to the nuances of persuasive communication
Speaking: debates – Just-A Minute Activities
Reading: reading texts on advertisements (on products relevant to the subject areas) and answeringinferential questions
Writing: dialogue writing- writing an argumentative /persuasive essay.

UNIT III- Digital Competence (18 hrs)

Listening to interviews (subject related)
Speaking: Interviews with subject specialists (usingvideo conferencing skills)
Creating Vlogs (How to become a vlogger and use vloggingtonurture interests – subject related)
Reading: Selected sample of Web Page (subject area)
Writing: Creating Web Pages
Reading Comprehension: Essay on Digital Competence for Academic and Professional Life.
The essay will address all aspects of digital competence in relation to MS Office and how they can be utilized in relation to work in the subject area

UNIT IV - Creativity and Imagination (18 hrs)

Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos on Indian academic sites – E.g. https://www.youtube.com/watch?v=tpvicScuDy0)
Speaking: Making oral presentations through short films – subject based
Reading: Essay on Creativity and Imagination (subject based)

Writing – Basic Script Writing for short films (subject based)
Creating blogs, flyers and brochures (subject based)
Poster making – writing slogans/captions(subject based)

UNIT V- Workplace Communication& Basics of Academic Writing **(18 hrs)**

Speaking: Short academic presentation using PowerPoint
Reading & Writing: Product Profiles, Circulars, Minutes of Meeting.
Writing an introduction, paraphrasing
Punctuation(period, question mark, exclamation point, comma, semicolon, colon, dash, hyphen, parentheses, brackets, braces, apostrophe, quotation marks, and ellipsis)
Capitalization (use of upper case)

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20UPH2PE2		Professional English for Physical Sciences-II			2			2	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (POs)**				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓			✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) = 47 Relationship: **VERY 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 Present in the course: 30

Total Number of Topics	**Number of Topics**				**Category Based on %**
	Local	**Regional**	**National**	**Global**	
30	**6**	**6**	**12**	**6**	**National**

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

SEMESTER – III

Course Code: 20UMA3CC4 Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 5 External Marks: 75

CORE COURSE – IV–INTEGRAL CALCULUS

Course Outcomes:

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

1. Revision of all the basic concept of integral models.
2. Solving technique of integrals, Integration by parts and Bernoulli's formula
3. To learn evaluation of double and triple integration and its application to area and volume.
4. Perform a change of variables and use polar co-ordinates to evaluate a double integral.
5. Discuss Beta & Gamma functions.

UNIT – I

INTEGRATION:Introduction – Methods of integrations – Integration of Rational Algebraic function –Simpleproblems

UNIT – II

Properties of Definite Integrals – Integration by parts - Reduction Formula- Bernoulli's formula

UNIT – III

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

UNIT – IV

Change of Variables: Jacobian – Change of variables in the case of two and three variables – Transformation from Cartesian to polar coordinates - Transformation from Cartesian to spherical polar coordinates

UNIT – V

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

TEXT BOOK(S):

1. S.Narayanan, T.K.ManicavachagomPillai,"IntegralCalculus,Volume II, S.V.Publications,.

UNIT – I	Chapter – 1	Sections 1 to 10 of [1]
UNIT – II	Chapter – 1	Sections 11 to 14, 15.1 of [1]
UNIT – III	Chapter – 5	Sections 1 to 7 of [1]
UNIT – IV	Chapter – 6	Sections 1.1 to 2.4 of [1]
UNIT – V	Chapter – 7	Sections 1.1to 6of [1]

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
III	20UMA3CC4		INTEGRAL CALCULUS			5		5	
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(✓) = **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**	
16	**3**	**3**	**3**	**16**	**Global**

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

SEMESTER – III

Course Code: 20UMA3CC5 Exam Hours: 3
Instruction Hours: 5 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE – V -DIFFERENTIAL EQUATIONS

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 constantcoefficients, Complementary function and Particular integrals.
4. Discuss and demonstrate the Linear equations with variable coefficientsand 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- Simultaneous differential equations of the form $f_1(D)x + g_1(D)y = h_1(t)$, $f_2(D)x + g_2(D)y = h_2(t)$.

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 ,particularand 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. ManicavachagamPillai, 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	Chapters – 4& 6	Sections 1 to 3 & 6
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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
III	20UMA3CC5		DIFFERENTIAL EQUATIONS			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**	
18	**0**	**0**	**0**	**18**	**Global**

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

SEMESTER – III

Course Code: 20UMA3AC3 Exam Hours: 3
Instruction Hours: 4 Internal Marks: 25
Credits: 4 External Marks: 75

ALLIED COURSE – III - MATHEMATICAL STATISTICS– I

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 Proveaddition 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: Formationof frequency distribution - Various measures of Central Tendency– Mean – Median – Mode -Geometric mean - Harmonic mean (Simpleproblems only).

UNIT – II

Measures of dispersion:Range-quartile deviation- mean deviation - standard deviation –coefficient of dispersion– Skewness and kurtosis(Simpleproblems only).

UNIT – III

Probability: Definitions of various terms - Axiomatic Probablity- Random Event – MathematicalProbability - Addition and Multiplication Laws of Probability - Independent events – ConditionalProbability – Baye's theorem –Simpleapplications.

UNIT – IV

Random Variables: Distribution functions - Discrete random variable - Continuous random variable - Joint Probability mass function - Joint Probability distribution function - Marginal distributionfunction- 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 –Characteristicfunction - Probability generating function.

TEXT BOOK:

1. Gupta S.C. and Kapoor V.K., Fundamendals of Mathematical Statistics – Sultan Chand & Sons, 2002.

UNIT – I	Chapter – 2	Sections 2.3 to 2.9
UNIT – II	Chapter – 2	Sections 2.13, 2.14, 2.16, 2.17
UNIT – III	Chapter – 3	Sections 3.3, 3.4, 3.8.5 to 3.12
UNIT – IV	Chapter – 5	Sections 5.1 to 5.5.5
UNIT – V	Chapter – 6	Sections 6.2 to 6.6.1

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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
III	20UMA3AC3		MATHEMATICAL STATISTICS – I			4		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**	
36	**3**	**3**	**3**	**36**	**Global**

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

SEMESTER – III

Course Code: 20UMA3NME1 Exam Hours: 3

Instruction Hours: 2 Internal Marks: 25

Credits: 2 External Marks: 75

NON MAJOR ELECTIVE –I

MATHEMATICS FOR COMPETITIVE EXAMINATIONS – I

Course Outcomes

- Solve the problems based on Numbers
- Understand the HCF, LCM and decimal fractions
- Solve the problems based on Square roots, cube roots.
- Solve the problems based on percentage, average and ratio.
- Solve the problems on partnership, chain rules.

UNIT – I

Numbers: Problemson 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 andL.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 – Problemsbased 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
III	20UMA3NME1		MATHEMATICS FOR COMPETITIVE EXAMINATIONS – I			2		2	
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 (✓) = **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: 20UMA4CC6 Exam Hours: 3
Instruction Hours: 4 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE - VI - LAPLACE TRANSFORMS AND FOURIER TRANSFORMS

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. Study the concept of Fourier integral theorem complex form of the Fourier integral.
5. Deep study for Properties of Fourier Transformation and Convolution Theorem and Solve the cosine and sine transformation and Parseval's Identities.

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 Transforms: Dirichlet's Conditions- Fourier Series – Fourier Integral formula – Fourier Transform with inversion Theorem- Fourier sine and cosine transform with inversion Formula.

UNIT – V

Fourier Transforms (Continued): Properties of Fourier Transform - Theorems on Fourier Transform – Multiple Fourier Transforms – Convolution – Parseval's Identity.

TEXT BOOK(S):

1. S. Narayanan and T.K. ManicavachagomPillay, Differential Equations and its Applications, S. Viswanathan (Printers and Publishers) Pvt., Ltd. 2011.
2. Vasishtha, Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2008.

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 6.1 to 6.9 [2]

UNIT – V Chapter – 6 Sections 6.10 to 6.19 [2]

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
IV	20UMA4CC6		LAPLACE TRANSFORMS AND FOURIER TRANSFORMS			4		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(✓) = **34**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**	
22	**2**	**2**	**2**	**22**	**Global**

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

SEMESTER – IV

Course Code: 20UMA4CC7 Exam Hours: 3
Instruction Hours: 4 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE - VII - VECTOR CALCULUS ANDFOURIER SERIES

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, Line, Surface andVolume integral.
4. Evaluate Gauss divergence theorem, Stoke's theorem andGreen's theorem.
5. Finding Fourier expansion of aperiodic function with period 2π.

UNIT – I

Vector Differentiation: Differential Operators: Definition (Directional derivatives)–Differential Operator ∇ (del) – Operators a.∇ (a being unit vector) - The grad of a scalar point function – Properties of grad $\emptyset$ - Equation of tangent plane & normal -Divergence and curl of a vector pointfunction – Div f and Curl f are independent of the choice of axes- Simple Problems.

UNIT – II

Differential Operators (Continued): The Laplacian operator ∇^2 –Grad -Div& Curl of sums & Products – Div (grad $\emptyset$)- curl (grad $\emptyset$) - div (curl f) - curl (curl f) - grad (div f).

UNIT – III

Vector Integration: Line Integral –Normal surface Integral –Flux across a surface - Volume integral.

UNIT – IV

Vector Integration (Continued): Gauss divergence Theorem (without proof)- Stoke'sTheorem (without proof)- Green's Theorem (without proof)-Stoke's Theorem in Space-Stoke's Theorem in cartesian form.

UNIT – V

Fourier Series: Definition of Fourier series- Finding Fourier expansionof a periodic function with period 2π– Even and Odd functions and their properties – Half range Fourier series – Development in cosine and Sine Series.

TEXT BOOK(S):

1. M.L. Khanna, Vector Calculus, Jai PrakashNath and Co., 8th Edition, 1986.
2. S.Narayanan and T.K ManicavachagomPillay, Calculus Volume - III, S.ViswanathanPublishers Pvt., Ltd. 2011.

UNIT – I	Chapter – 1	Sections 1 to 8 of [1]
UNIT – II	Chapter – 1	Sections 9 to 12 of [1]
UNIT – III	Chapter – 3	Sections 1 to 4 of [1]
UNIT – IV	Chapter – 3	Sections 5 to 8 of [1]
UNIT – V	Chapter – 6	Sections 1 to 5 of [2]

REFERENCE(S):

1. P.Duraipandiyan and Lakshmi Duraipandian, Vector Analysis, Emarald publishers, 1986.
2. Dr. S.Arumugam and Prof. A.ThangapandiIssac, Fourier series, New Gammapublishing house, Nov 2012.
3. A.R. Vasishtha, R.K. Gupta, Integral Transforms, Krishna Prakashan Media PvtLtd, India, 2002.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
IV	20UMA4CC7		VECTOR CALCULUS AND FOURIER SERIES			4			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**	
31	**1**	**1**	**1**	**31**	**Global**

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

SEMESTER – IV

Course Code: 20UMA4AC4 Exam Hours: 3
Instruction Hours: 4 Internal Marks: 25
Credits: 4 External Marks: 75

ALLIED COURSE - IV - MATHEMATICAL STATISTICS - II

Course Outcomes:

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

- Understand the concept of Correlation.
- Compute types of sampling parameter and statistics,Tests of significance and Null Hypothesis.
- Understand Student's t-test of Difference of means.
- Gain knowledge in sampling theory.
- 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'sFtest and itsproperties – 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 –.SimpleProblems.

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:2002, 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 463 [2]
UNIT – IV	Chapter – 8	Page no. 422 to 441[2]
UNIT – V	Chapter – 8	Page no. 466 to 481 [2]

REFRENCES:

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**	
IV	20UMA4AC4		MATHEMATICAL STATISTICS - II			4		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(✓) = **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: 20UMA4AP2 Exam Hours: 3
Instruction Hours: 4 Internal Mark: 40
Credits: 3 External Marks: 60

ALLIED PRACTICAL– II

MATHEMATICALSTATISTICS LAB

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.

LIST OF PRACTICAL:

1.Mean, Standarddeviation, Variance.
2. Line diagram, Pie chart andHistogram.
3. Co efficientof correlation.
4.Regression equation of X on Y.
5. Regression equation of Y on X.
6.Application of t-testfor one sampleproblem.
7. Applicationof t-testfor two sampleproblems.
8. Applicationof t-test for testing the significanceof Correlation Coefficient.
9.One-tailed and Two-tailed tests.
10.Applicationof analysisof variance.

TEXT BOOK:

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2002, Sultan Chand & Sons publications, New Delhi.
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**		
IV	20UMA4AP2		MATHEMATICAL STATISTICS LAB			4		3		
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(✓) = **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	**5**	**10**	**6**	**9**	**Regional**

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

SEMESTER – IV

Course Code: 20UMA4NME2 Exam Hours: 3

Instruction Hours: 2 Internal Marks: 25

Credits: 2 External Marks: 75

NON MAJOR ELECTIVE – II

MATHEMATICS FOR COMPETITIVE EXAMINATIONS – II

Course Outcomes:

1. Solve the problems based on Time and work, Pipes and Cisterns.
2. Understand problems on time, trains and streams.
3. Solve the problem based on profit, loss and mixture.
4. Solve the problems based on Simple Interest and Compound Interest.
5. Understand Problems on Volume and Surface Area.

UNIT – I

Time and work - Pipes and Cisterns.

UNIT – II

Time and Distance – Trains - Boats and Streams.

UNIT – III

Profit and Loss - Mixture.

UNIT – IV

Simpleinterest–Compoundinterest- Calendar.

UNIT – V

Volume and Area of Solid figures.

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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
IV	20UMA3NME2		MATHEMATICS FOR COMPETITIVE EXAMINATIONS – II			2		2	
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 (✓) = **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**	
11	**0**	**2**	**10**	**9**	**National**

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

SEMESTER – IV

Course Code: 20UMA4SBE1 Exam Hours: 3

Instruction Hours: 2 Internal Marks: 25

Credits: 2 External Marks: 75

SKILL BASED ELECTIVE – I

MATHEMATICS FOR COMPETITIVE EXAMINATION – I

Course Outcomes:

- Solve the problems based on Numbers
- Understand the decimal fractions and simplification.
- Solve the problems based on Surds, Indices, Percentage, Profit and Loss,.
- Solve the problems based on Ratio and Proportion
- Solve the problems on Age.

UNIT – I

Numbers– HCF –LCM – Problems on numbers

UNIT – II

Decimal Fractions-Simplification.

UNIT – III

Surds and Indices – 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 - 9, 10 & 11
UNIT – IV	Chapters - 12, 13 & 20
UNIT – V	Chapters - 6 & 8

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
IV	20UMA4SBE1	MATHEMATICS FOR COMPETITIVE EXAMINATION-I	2	2

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**	
14	**1**	**3**	**8**	**6**	**National**

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

SEMESTER – V

Course Code: 20UMA5CC8
Instruction Hours: 5
Credits: 5

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

CORE COURSE - VIII - ALGEBRA

Course Outcomes:

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

1. Recognize the mathematical objects called groups.
2. Find cycles and transpositions of a given permutations.
3. Explain the significance of the notions of cosets, normal subgroups, and factor groups.
4. Gains knowledge in Ring theory.
5. Learn the construction of field of quotients of an integral domainandpolynomial rings.

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 cyclicgroups –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 – Types of rings – Elementary properties of a ring – IntegralDomain – Field – Sub rings – Sub fields – Ideals – Left ideal – Right ideal – Principal ideal – quotient ring – Maximal and prime Ideals – Characteristic of a ring – PID –Homomorphisms – Isomorphism – Kernel of a Homomorphism – Fundamental theorem of Homomorphism.

UNIT – V

Rings (Continued): Field of quotients of Integral domain – U.F.D. - Polynomial rings – Division algorithm – Polynomial rings over UFD – Gauss lemma – Polynomials over the rational field – Eienstein's criterion.

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 4.10
UNIT –V	Chapter –4	Sections 4.11, 4.13, 4.16 to 4.18

REFERENCE(S):

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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
V	20UMA5CC8	ALGEBRA	5	5

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**	
56	**2**	**2**	**2**	**56**	**Global**

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

SEMESTER – V

Course Code: 20UMA5CC9
Instruction Hours: 5
Credits: 5

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

CORE COURSE -IX - REAL ANALYSIS

Course Outcomes:

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

1. Study various types of sets and relations, and concept of countable and uncountable
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 integration

UNIT – I

Real Number system: The field axioms -the order axioms -the rational numbers -the irrational numbers -upper bounds - maximum element - least upper bound (supremum)-The completenessaxiom- some properties of the supremum- Absolute values - The triangle inequality- the CauchySchwarz's inequality.

UNIT – II

Elements of point set Topology: Euclidean space -Open sets and closed sets–BolzanoWeierstrass theorem- The Cantor Intersection theorem– Coverings-Lindelof covering 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 R^1.

UNIT – IV

Connectedness, Completeness and Compactness: -Connectedness - Bounded setsandtotallybounded 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 1.3, 1.8 to 1.14, 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 [1]
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:

1.ViswanathNaik, 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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
V	20UMA5CC9	REAL ANALYSIS	5	5

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**	
34	**0**	**0**	**0**	**34**	**Global**

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

SEMESTER – V

Course Code: 20UMA5CC10
Instruction Hours: 5
Credits: 4

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

CORE COURSE - X - STATICS

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 forcesacting 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 20
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.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits

V	20UMA5CC10	STATICS				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(✓) = **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: 20UMA5CC11 Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 4 External Marks: 75

CORE COURSE - XI - PROGRAMMING IN C

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. Gain knowledge about different types of statements
3. Define Functions and Recursion.
4. Implement different operations on arrays.
5. Understand pointers and structures.

UNIT – I

C fundamentals Character set - Identifier and keywords - data types - constants - Variables - Declarations - Expressions - Statements –Arithmetic-Unary- Relational and logical- Assignment and Conditional Operators - Library functions.

UNIT – II

Data input output functions - Simple C programs - Flow of control if-ifelse – while –dowhile - for loop- Nested control structures – Switch- break and continue- go to statements - Comma operator.

UNIT – III

Functions -Definition–prototypes - Passing arguments – Recursions- Storage Classes – Automatic- External- Static- Register Variables –Multifile programs.

UNIT – IV

Arrays - Defining and Processing - Passing arrays to functions – Multidimension arrays - Arrays and String - Structures - User defined data types - Passing structures to functions –Selfreferential structures - Unions - Bit wise operations.

UNIT – V

Pointers - Declarations - Passing pointers to Functions - Operation in Pointers - Pointer and Arrays - Arrays of Pointers - Structures and Pointers

Files: Creating Processing- Opening and Closing a data file.

TEXT BOOK

1. E.Balagurusamy, “Programming in ANSI C”, Fifth Edition, Tata McGraw Hill.

REFERENCE BOOKS:

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

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
V	20UMA5CC11	PROGRAMMING IN C	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(✓) = **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**	
56	**0**	**0**	**0**	**56**	**Global**

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

SEMESTER – V

Course Code: 20UMA5MBE1:1
Instruction Hours: 4
Credits: 3

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

MAJOR BASED ELECTIVE - I - NUMERICAL METHODS

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. Solve Interpolation of Finite differences – Newton's Forward,Central and Backward differences
3. Obtain the Numerical differentiation and integration.
4. Find the solution of linear system of equation by Gaussian Elimination, Gauss Jacobi, and Gauss Seidel Methods
5. Derive and compute the solution of Taylor series, Picard's andEuler 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 -Method of False Position-Newton Raphson Method - Iteration Method.

UNIT – II

Finite Differences: Forward - Backward and Central differences – Their symbolic relations – Newton's forward - backward difference interpolation formulae – Interpolation with unevenly spaced intervals –Application of Lagrange's interpolating Polynomial (Proof not needed)– Divided differences and their properties – Application of Newton's General Interpolating formula. (Proof not needed).

UNIT – III

Numerical Integration: Numerical Integration using Trapezoidal rule - Simpson's first - Second rules - Theory and problems.

UNIT – IV

Solutions to Linear Systems: Gaussian Elimination Method – Jacobi- Gauss Siedal iterative methods – Theoryand problems

UNIT – V

Numerical Solution of ODE: Solution by Taylor Series Method - Picard's method - Euler's Method - Modified Euler's Method – RungeKutta 2^{nd}- 4^{th} order methods (Derivation of the formula not needed) - Theory and problemsusing Adam's Predictor Corrector Method -Milne's Predictor Corrector Methods

TEXT BOOK:

1. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt.Limited, 4^{th} Edition, 2009.

UNIT – I	Chapter – 2	Sections 2.1 to 2.5
UNIT – II	Chapter – 3	Sections 3.1, 3.3, 3.6, 3.9, 3.9.1, 3.10, 3.10.1
UNIT – III	Chapter – 5	Sections 5.2, 5.4 (5.4.1 to 5.4.3)
UNIT –IV	Chapter – 6	Sections 6.3.2 & 6.4
UNIT – V	Chapter – 7	Sections 7.1 to 7.6.2

REFERENCE(S):

1. S. Narayanan & Others, Numerical Analysis, S. Viswanathan Publishers, 1994.
2. A.Singaravelu, Numerical Methods, Meenachi Agency, June 2000.
3. Dr.P.Kandasamy, Dr.K.Thilagavty, Dr.K.Gunavathi, Numerical Methods, S.Chand&co.,Calculate the Numerical solution of ordinary differential equations.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
V	20UMA5MBE1:1	NUMERICAL METHODS	4	3
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(✓) = **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**	
29	**5**	**5**	**5**	**29**	**Global**

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

SEMESTER – V

Course Code: 20UMA5MBE1:2
Instruction Hours: 4
Credits: 3

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

MAJOR BASED ELECTIVE - I – DISCRETE MATHEMATICS

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 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 Biconditional 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**Booleanfunctions:**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	Sections1.3.1 to 1.3.5 & 1.5
UNIT – III	Chapter – 1	Sections 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
V	20UMA5MBE1:2		DISCRETE MATHEMATICS			4			3	
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(✓) = **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**	
26	**1**	**1**	**1**	**26**	**Global**

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

SEMESTER – V

Course Code: 20UMA5SBE2 Exam Hours: 3

Instruction Hours: 2 Internal Marks: 25

Credits: 2 External Marks: 75

SKILL BASED ELECTIVE –II

MATHEMATICS FORCOMPETITIVE EXAMINATION – II

Course Outcomes:

1. Solve the problems based on Chain Rule, Time and work, Pipes and Cisterns.
2. Understand problems on trains and streams.
3. Solve the problems based on Simple Interest andCompound 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 andDistance–Problems on Trains – Boats andStreams

UNIT – III

Simple Interest– Compoundinterest- Stocks and Shares.

UNIT – IV

Clocks – Area – VolumeandSurface 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 21, 22 & 29
UNIT – III	Chapters 17, 18 & 19
UNIT – IV	Chapters 24, 25 & 28
UNIT – V	Chapters 30 & 31

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
V	20UMA5SBE2	MATHEMATICS FOR COMPETITIVE EXAMINATION – II	2	2

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**	
13	**1**	**3**	**11**	**8**	**National**

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

SEMESTER – V

Course Code: 20UMA5SBE3
Instruction Hours: 2
Credits: 2

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

SKILL BASED ELECTIVE - III –MATLABAPPLICATIONS

Course Outcomes:

1. Learn features of MATLAB as a programming tool.
2. Recognize and relate matrix vector indexing and creating vector in MATLAB platform.
3. Describe matrix and array operation.
4. Formulate inline and built in function
5. Able to generate 2D and 3D plots to graphs.

UNIT – I

Introduction to MATLAB-Basics of MATLAB- MATLAB windows-online help-inputoutput-File types- Platform dependence.

UNIT – II

Matrix and Vectors-Indexing-Matrix Manipulation-Creating Vectors

UNIT – III

Matrix and Array operations-Arithmetic operations-Relational operations-logical operations-elementary math functions-matrix functions-character strings.

UNIT – IV

Creating Inline functions-using Inline functions-using builtin functions.

UNIT – V

Plotting simple graphs-2D plots using fplot-ezplot -ezpolar-3D plots using ezplot3-ezcontour-ezcontourf-ezsurf-ezsurfc.

TEXT BOOK:

1. Getting started with MATLAB 7 (2008) RudraPratap, Oxford University Press.

UNIT – I	Chapter – 1	Sections 1.1, 1.2, 1.6
UNIT – II	Chapter – 3	Sections 3.1
UNIT – III	Chapter – 3	Sections 3.2
UNIT – IV	Chapter – 3	Sections 3.3, 3.4
UNIT – V	Chapter –5	Sections3.6

REFERENCE BOOKS:

1. Brian R.Hunt, Ronald L.Lipsman,Jonathan M. Rosenberg, A guide to MATLAB beginners and Experienced Users, Cambridge University Press edition, 2002.
   Website: www.ann.jussieu.fr/free.htm.
2. MATLAB–The language of technical computing, The MATH WORKS Inc., Version 5 1996 (http:\\www.mathworks.com)

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits

V	20UMA5SBE3	MATLAB APPLICATIONS			2			2	
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**	
30	**3**	**4**	**12**	**11**	**National**

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

SEMESTER – VI

Course Code: 20UMA6CC12
Instruction Hours: 5
Credits: 5

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

CORE COURSE - XII - 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 andExample– 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: Introduction -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& 8	Sections 7.6& 7.8& 8.0 to 8.2

REFERENCE(S):

1. N. Herstein, Topics in Algebra, Second Edition, John Wiley & Sons (Asia),1975.
2. Dr. M.K.Venkataramany, the National Publishing Company.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
VI	20UMA6CC12		LINEAR ALGEBRA			5			5	
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**	
26	**3**	**3**	**3**	**26**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6CC13
Instruction Hours: 6
Credits: 5

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

CORE COURSE - XIII - COMPLEX ANALYSIS

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 Conformal Mapping, 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

Fieldof complex numbers – Conjugation – Geometrical representation of complex numbers – Extended complex plane and steriographic projection

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

UNIT – II

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 – Rouche's theorem – Fundamentaltheorem 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 –1	Sections 1.1, 1.2, 1.5, 1.9
	Chapter – 2	Sections 2, 2.1, & 2.4 to 2.8
UNIT –II	Chapter–3	Sections 3.2 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
VI	20UMA6CC13		COMPLEX ANALYSIS			6		5	
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(✓) = **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	**Number of Topics**				**Category Based on %**
	Local	**Regional**	**National**	**Global**	
27	**2**	**2**	**2**	**27**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6CC14 Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 4 External Marks: 75

CORE COURSE - XIV - DYNAMICS

Course Outcomes:

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

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

UNIT – I

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

UNIT – II

Laws of Motion:Principles of Work - Power and Energy.

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

UNIT – III

Impulsive forces: Collision of elastic bodies - Laws of Impact - Direct and oblique impact – Impacton a fixed plane- Direct impact of two smooth spheres-Loss of kinetic energy during direct impact.

UNIT – IV

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 – V

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

Motion of a rigid body about fixed axis: Angular momentum of a rigid body about an axis ofrotation - Conservation of angular momentum.

TEXT BOOK:

1. Dr.M.K.Venkataraman, Dynamics, Agasthiyar Publications, 14th Edition, July 2011.

UNIT – I	Chapter – 12	Sections 12.1 to 12.4
UNIT – II	Chapters – 4 & 6	Sections 4.3, 4.24 to 4.36& 6.2 to 6.6, 6.12 to 6.16
UNIT – III	Chapters – 7 &8	Sections 7.2 to 7.4 & 8.1 - 8.9
UNIT – IV	Chapter – 10	Sections 10.1 to 10.7
UNIT – V	Chapters – 11& 13	Sections 11.1 to 11.9, 11.14& 13.2 to 13.5

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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
VI	20UMA6CC14		DYNAMICS			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(✓) = **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**	
26	**0**	**0**	**0**	**26**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6MBE2:1 | Exam Hours: 3
Instruction Hours: 5 | Internal Marks: 25
Credits: 3 | External Marks: 75

MAJOR BASED ELECTIVE - II - OPERATIONSRESEARCH

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 Methodof 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 - 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 MaximinPrinciple- Minimax Principle – Gameswithout Saddle Points - Mixed Strategies - Graphical Solution of 2 x n and m x 2 games - Dominance Property.

UNIT – V

Network Scheduling by PERT / CPM: Network - basic components - Rules of NetworkConstruction - Time Calculation in network -Critical Path Method - PERT Calculation.

TEXT BOOK:

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

UNIT – I	Chapters – 2& 4	Sections 2.1 to 2.3, & 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.

Relationship Matrix for COs, POs and PSOs

Semester	Code		Title of the Course			Hours			Credits	
VI	20UMA6MBE2:1		OPERATIONS RESEARCH			5			3	
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**	
24	**0**	**0**	**0**	**24**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6MBE2:2
Instruction Hours: 5
Credits: 3

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

MAJOR BASED ELECTIVE– II - ASTRONOMY

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 horizontal
4. Distinguish Kepler'slaws .
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 – LunarLibration - 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 - Solar System.

TEXT BOOK:

1. S. Kumaravelu and Prof. SusheelaKumaravelu, Astronomy, SKV Publications, 1995.

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 & 17	

REFERENCE:

1. V. Thiruvenkatacharya, 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).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
VI	20UMA6MBE2:2		ASTRONOMY			5		3	
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(✓) = **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**	
53	**0**	**0**	**0**	**53**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6MBE3:1
Instruction Hours: 5
Credits: 3

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

MAJOR BASED ELECTIVE – III – GRAPH THEORY

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. Derive some properties on Planar and dual graphs.
4. Demonstrate Matrix Representation of graphs.
5. Illustrate an Algorithm for Vertex colouring.

UNIT - I

Basics: Graphs – Pictorial representation – Subgroups – Isomorphism and degrees – Walks andconnected 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 Problems – Matrix representations – Vector spaces associated with graphs – Cycle space – cut-set space.

UNIT - IV

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

UNIT - V

Colourings: Vertexcolouring– Edge colourings– An algorithm for vertex colouring.

TEXT BOOK:

1. Choudum.S.A. – A First Course in Graph Theory, Macmillan India Limited, 1987.

UNIT – I	Chapter – 1	Sections 1.1 to 1.7
UNIT – II	Chapter – 2	Sections 2.1 to 2.4
UNIT – III	Chapters – 3 & 4	Sections 3.1 to 3.4 & 4.1 to 4.4
UNIT – IV	Chapter – 5	Sections 5.1 to 5.5
UNIT – V	Chapter – 6	Sections 6.1 to 6.3

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].

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
VI	20UMA6MBE3:1	GRAPHTHEORY	5	3
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(✓) = **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**	
27	**1**	**1**	**1**	**27**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6MBE3:2 Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 3 External Marks: 75

MAJOR BASED ELECTIVE – III - NUMBER THEORY

Course Outcomes:

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

1. Acquire the basic knowledge of numbers and their properties.
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 Diophontine 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).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
VI	20UMA6MBE3:2		NUMBER THEORY			5			3	
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(✓) = **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**	
21	**0**	**0**	**0**	**21**	**Global**

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

SEMESTER – VI

Course Code: 20UMA6CP1 Exam Hours: 3

Instruction Hours: 3 Internal Marks: 40

Credits: 3 External Marks: 60

PROGRAMMINGIN C LAB

Course Outcomes

1. Solve the Trigonometric equations and Comparison with built in functions.
2. Learn string and substring manipulations.
3. Recognize and understand the constructions of C PROGRAMME for Fibonacci sequence and .Maximum & Minimum
4. Solve problems usingMatrix Manipulation.
5. Analysis various sorting and searching.

I - Summation of Series

1. Sin(x), 2. Cos(x),3.Exp(x) (Comparison with built in functions)

II - String Manipulation

1. Counting the number of vowels, consonants, words, white spaces in a line of text and array of lines.
2. Reverse a string and check for palindrome.
3. Sub string detection, count and removal.
4. Finding and replacing substrings.

III - Recursion

1. nPr, nCr 2. GCD of two numbers 3. Fibonacci sequence 4.Maximum& Minimum

IV - Matrix Manipulation

1. Addition and Subtraction2.Multiplication3.Transpose, and trace of a matrix 4. Determinant of a Matrix

V - Sorting and Searching

1. Insertion Sort
2. Bubble Sort
3. Linear Search
4. Binary Search

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
VI	20UMA6CP1		PROGRAMING IN C (PRACTICAL)			3			3	
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(✓) = **34** 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	**2**	**2**	**8**	**7**	**National**

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

ALLIED MATHEMATICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 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:

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)

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

(For the candidates admitted from the academic year 2020 - 2021 onwards)

ALLIED MATHEMATICS

ALLIED COURSE -I -NUMERICAL METHODSAND STATISTICS

Course Code: **20UMA1AC1** Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 3 External Marks: 75

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, Gauss Seidel Methods.
3. Evaluate finite integrals using Trapezoidal and Simpsonsruleand 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- RugulaFalsi Method- Newton Raphson Method–Simple Problemsonly

.

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 Problemsonly.

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 1994.

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]
UNIT – V	Chapter – 10	Sections 10.1 to10.3, 10.3.1, 10.6, 10.7 & 10.7.1 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.
3. C.E. Froberg, "Introduction to Numerical Analysis", II Edn., Addison Wesley, 1979.
4. 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	20UMA1AC1		NUMERICAL METHODS AND STATISTICS			5			3	
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(✓) = 36Relationship: **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,

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

(For the candidates admitted from the academic year 2020 - 2021 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - II – OPERATIONSRESEARCH

Course Code: **20UMA2AC2** Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 3 External Marks: 75

CourseOutcomes

1. Recognize and relate LPP and solving LPP using graphical method.
2. Compute Simplex Algorithm, Two Phase Method and Big-M Methodof 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.

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
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	20UMA2AC2		OPERATIONS RESEARCH			5		3		
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(✓) = **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**	
23	**0**	**0**	**0**	**23**	**Global**

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

B.Sc., PHYSICS

(For the candidates admitted from the academic year 2020-21 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - I –ALGEBRA ANDCALCULUS

Course Code: **20UMA1AC1:1** Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 3 External Marks: 75

Course Outcomes

1. To find maxima and minima,critical points and inflection points of functions
2. Solving technique of integrals and Integration by parts
3. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.
4. Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots
5. Solve systems of linear equations by use of the matrix.

UNIT – I

Differentiation: Maxima&Minima – Concavity,Convexity – Points of inflexion - Partial differentiation– Euler's Theorem- Total differential coefficients (proof not needed) –Simple Problemsonly

UNIT II

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 – Properties of definite integrals

UNIT III

Differential Equations: VariablesSeparables– Linear equations– Second order of types$(a\ D^2 + bD + c)\ y = F\ (x)$ 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 - (iv) e^{Kx} f (x)

UNIT IV

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) – Simpleproblems.

UNIT V

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)–Simpleapplications only

TEXT BOOK(S):

1. T.K. ManickavasagamPillai& Others, Algebra, Vol I, S.V Publications , 2004 (Unit I)

2. T.K. ManickavasagamPillai& Others, Algebra, VolII, S.V Publications, Pvt.Ltd 2011. (Unit II)
3. S. Narayanan, T.K. ManicavachagamPillai, Calculus, Vol. I, S. ViswanathanPvt Limited, 2010. (Units III)
4. S. Narayanan, T.K. ManicavachagamPillai, Calculus, Vol. II, S. ViswanathanPvt Limited, 2011. (Units IV)
5. S. Narayanan, T.K. ManicavachagamPillai, Calculus, Vol. III, S. ViswanathanPvt 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 7,8,9,11,12 of [4]
UNIT – V	Chapter – 1 & 2	Sections 2.1, 2.4& 1 to 4 of [5]

REFERENCE:

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.
2. S. RethinaKumar, "Algebra and Calculus", Sai Publication – 2015.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
I	20UMA1AC1:1		ALGEBRA ANDCALCULUS			5		3	
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(✓) = 35Relationship: **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	**3**	**3**	**3**	**32**	**Global**

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

B.Sc., PHYSICS

(For the candidates admitted from the academic year 2020-21 onwards)

ALLIED MATHEMATICS

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

Course Code: **20UMA2AC2:1** Exam Hours: 3

Instruction Hours: 4 Internal Marks: 25

Credits: 3 External Marks: 75

Course Outcomes

1. Describe the equation of a straight line passing through two given pointsand shortest distance between two skew lines.
2. Finding centre, radius and length of the tangent plan to a sphere.
3. Expansion of *sin nx, cosnx, tan nx* and powers of *sines* and cosines interms of functions of multiples ofθ
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- Findingcentreand radius- Length of the tangent to a sphere- Plane section of a sphere

UNIT – III

Expansion of sin nθ ,cosnθ ,tan nθ (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 sinθ , cosθ and tanθ 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 ,coshx , tan hx in powers of x

UNIT – V

Definition of Fourier Series– Finding Fourier expansion of a periodic function with period 2π-Use ofOdd &Even functions in evaluating Fourier Coefficients - Half range sine & cosine series.

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. 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 5 of [3]

Relationship Matrix for COs, POs and PSOs

Semester	**Code**	**Title of the Course**	**Hours**	**Credits**
II	20UMA2AC2:1	ANALYTICAL GEOMETRY (3D), TRIGONOMETRYAND FOURIER SERIES	4	3

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(✓) = 35Relationship: **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	**3**	**3**	**3**	**21**	**Regional**

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

B.Sc., CHEMISTRY

(For the candidates admitted from the academic year 2020-21 onwards)

ALLIED MATHEMATICS

ALLIED COURSE - I –ALGEBRA ANDCALCULUS

Course Code: **20UMA3AC3:1** Exam Hours: 3

Instruction Hours: 5 Internal Marks: 25

Credits: 3 External Marks: 75

Course Outcomes

1. To find maxima and minima,critical points and inflection points of functions
2. Solving technique of integrals and Integration by parts
3. Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals.
4. Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots
5. Solve systems of linear equations by use of the matrix.

UNIT – I

Differentiation: Maxima&Minima – Concavity,Convexity – Points of inflexion - Partial differentiation– Euler's Theorem- Total differential coefficients (proof not needed) –Simple Problemsonly

UNIT II

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 – Properties of definite integrals

UNIT III

Differential Equations: VariablesSeparables– Linear equations– Second order of types$(a\ D^2 + bD + c)\ y = F\ (x)$ 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 - (iv) e ^{Kx} f (x)

UNIT IV

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) –Simpleproblems.

UNIT V

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)–Simpleapplications only

TEXT BOOK(S):

6. T.K. ManickavasagamPillai& Others, Algebra, Vol I, S.V Publications , 2004 (Unit I)
7. T.K. ManickavasagamPillai& Others, Algebra, VolII, S.V Publications, Pvt.Ltd 2011. (Unit II)
8. S. Narayanan, T.K. ManicavachagamPillai, Calculus, Vol. I, S. ViswanathanPvt Limited, 2010. (Units III)
9. S. Narayanan, T.K. ManicavachagamPillai, Calculus, Vol. II, S. ViswanathanPvt Limited, 2011. (Units IV)
10. S. Narayanan, T.K. ManicavachagamPillai, Calculus, Vol. III, S. ViswanathanPvt 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 7,8,9,11,12 of [4]
UNIT – V	Chapter – 1 & 2	Sections 2.1, 2.4& 1 to 4 of [5]

REFERENCE:

3. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.
4. S. RethinaKumar, "Algebra and Calculus", Sai Publication – 2015.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
I	20UMA3AC3:1		ALGEBRA ANDCALCULUS			5		3	
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(✓) = 35Relationship: **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	**3**	**3**	**3**	**32**	**Global**

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

B.Sc., CHEMISTRY

(For the candidates admitted from the academic year 2020-21 onwards)

ALLIED MATHEMATICS

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

Course Code: **20UMA4AC4:1** Exam Hours: 3

Instruction Hours: 4 Internal Marks: 25

Credits: 3 External Marks: 75

Course Outcomes

6. Describe the equation of a straight line passing through two given pointsand shortest distance between two skew lines.
7. Finding centre, radius and length of the tangent plan to a sphere.
8. Expansion of *sin nx, cosnx, tan nx* and powers of *sines* and cosines interms of functions of multiples ofθ
9. Define and illustrate the concept of hyperbolic functions
10. 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- Findingcentreand radius- Length of the tangent to a sphere- Plane section of a sphere

UNIT – III

Expansion of sin nθ ,cosnθ ,tan nθ (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 sinθ , cosθ and tanθ 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 ,coshx , tan hx in powers of x

UNIT – V

Definition of Fourier Series– Finding Fourier expansion of a periodic function with period 2π-Use ofOdd &Even functions in evaluating Fourier Coefficients - Half range sine & cosine series.

TEXT BOOK(S):

4. T.K.ManickavasagomPillai, T.Natarajan, "Analytical Geometry (3D)" Part-II, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011.
5. S. Narayanan, T.K. ManichavasagamPillai, " Trigonometry", S. Viswanathan (Printers & Publishers, Pvt Limited, 2011.
6. 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 5 of [3]

Relationship Matrix for COs, POs and PSOs

Semester	**Code**	**Title of the Course**				**Hours**	**Credits**			
II	20UMA4AC4:1	ANALYTICAL GEOMETRY (3D), TRIGONOMETRYAND FOURIER SERIES				4	3			
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(✓) = 35Relationship: **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	**3**	**3**	**3**	**21**	**Global**

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

B.Sc., CHEMISTRY

(For the candidates admitted from the academic year 2020-21 onwards)

ALLIED MATHEMATICS

ALLIED COURSE – III – ODE, PDE AND LAPLACE TRANSFORMS

Course Code: **20UMA4AC5:1** 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 equationsPp+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 T heorems- Evaluation of Integrals.

UNIT – IV

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

UNIT – V

Laplace Transforms (Continued): Applicationof LaplaceTransforms-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**		
IV	20UMA4AC5:1		ODE, PDE AND LAPLACE TRANSFORMS			5		3		
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**	
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 2020-2021 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 multifaceted 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.
- 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 - Course Structure Under **CBCS**

(For the candidates admitted from the academic year 2020-2021 onwards)

Semester	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
1	20PMA1CC1	Linear Algebra	6	4	3	25	75	100
1	20PMA1CC2	Real Analysis	6	4	3	25	75	100
1	20PMA1CC3	Ordinary Differential Equations	6	4	3	25	75	100
1	20PMA1CC4	Classical Dynamics	6	4	3	25	75	100
1	20PMA1CC5	Advanced Graph Theory	6	4	3	25	75	100
Total			**30**	**20**	**-**	**-**	**-**	**500**
2	20PMA2CC6	Algebra	6	5	3	25	75	100
2	20PMA2CC7	Complex Analysis	6	5	3	25	75	100
2	20PMA2CC8	Partial Differential Equations	6	5	3	25	75	100
2	20PMA2EC1:1 20PMA2EC1:2 20PMA2EC1:3	Mathematical Statistics Probability Theory Tensor Analysis and Special Theory of Relativity	6	5	3	25	75	100
2	20PMA2EC2:1 20PMA2EC2:2 20PMA2EC2:3	Fuzzy sets and their Applications Control Theory Programming in C++	6	4	3	25	75	100
Total			**30**	**24**	**-**	**-**	**-**	**500**
3	20PMA3CC9	Topology	6	5	3	25	75	100
3	20PMA3CC10	Mathematical Methods	6	5	3	25	75	100
3	20PMA3CC11	Numerical Methods with MATLAB Programming	6	5	3	25	75	100
3	20PMA3EC3:1 20PMA3EC3:2 20PMA3EC3:3	Optimization Techniques Methods of Mathematical Physics Discrete Mathematics	6	5	3	25	75	100
3	20PMA3EC4:1 20PMA3EC4:2 20PMA3EC4:3	Stochastic Processes Combinatorics Automata Theory	6	4	3	25	75	100
Total			**30**	**24**	**-**	**-**	**-**	**500**
4	20PMA4CC12	Functional Analysis	6	5	3	25	75	100
4	20PMA4CC13	Differential Geometry	6	5	3	25	75	100
4	20PMA4EC5:1 20PMA4EC5:2 20PMA4EC5:3	Algebraic Number Theory Financial Mathematics Fluid Dynamics	6	4	3	25	75	100
4	20PMA4CP1	Numerical Methods with MATLAB Programming (Practical)	6	4	3	40	60	100
4	20PMA4PW	Project	6	4	-	-	-	100
Total			**30**	**22**	**-**	**-**	**-**	**500**
Grand Total			**120**	**90**	**-**	**-**	**-**	**2000**

List of Elective Courses

Elective	Course Code	Title of the Course
Elective – 1	20PMA2EC1:1 20PMA2EC1:2 20PMA2EC1:3	1. Mathematical Statistics 2. Probability Theory 3.Tensor Analysis and Special Theory of Relativity
Elective –2	20PMA2EC2:1 20PMA2EC2:2 20PMA2EC2:3	1. Fuzzy sets and their Applications 2. Control Theory 3. Programming in C++
Elective – 3	20PMA3EC3:1 20PMA3EC3:2 20PMA3EC3:3	1. Optimization Techniques 2. Methods of Mathematical Physics 3. Discrete Mathematics
Elective – 4	20PMA32EC4:1 20PMA3EC4:2 20PMA3EC4:3	1. Stochastic Processes 2. Combinatorics 3. Automata Theory
Elective –5	20PMA4EC5:1 20PMA4EC5:2 20PMA4EC5:3	1. Algebraic Number Theory 2. Financial Mathematics 3. Fluid Dynamics

Note:

Project : 100 Marks

Dissertation : 80 Marks

Viva Voce : 20 Marks

Core Papers - 13

Core Practical - 1

Elective Papers - 5

Project - 1

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**
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:

M.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)

SEMESTER – I

Course Code: 20PMA1CC1 | Exam Hours: 3
Instruction Hours:6 | Internal Marks: 25
Credits: 4 | External Marks: 75

CORE COURSE – I - LINEAR ALGEBRA

COURSE OUTCOMES:

At the end of the course, students will be able

1. Understand the signification of linear transformationsand 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.

UNIT – II

ALGEBRA OF POLYNOMIALS: The algebra of polynomials– Polynomials ideals– The prime factorization of a polynomial – Determinant functions.

UNIT – III

DETERMINANTS: Permutations and the Uniqueness of determinants–Classical adjointof a (square) matrix – Inverse of an invertible matrix using determinants – Characteristic values– Annihilating polynomials.

UNIT – IV

DIAGONALIZATION: Invariantsubspaces - Simultaneous triangulation - Simultaneous diagonalization – 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.

TEXT BOOK:

1. Kenneth M Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice – Hall of India Pvt.Ltd, New Delhi, 2013.

UNIT – I	Chapter – 3	Sections 3.1 to 3.5
UNIT – II	Chapters – 4 & 5	Sections 4.1,4.2, 4.4, 4.5 &5.1 to 5.2
UNIT – III	Chapters – 5 &6	Sections5.3, 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”4thEdition, Prentice-Hall of IndiaPvt. Ltd, 2009.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20PMA1CC1		LINEAR ALGEBRA			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 (✓)= 38Relationship: **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 – I

Course Code: 20PMA1CC2 Exam Hours: 3
Instruction Hours:6 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE –II- REAL ANALYSIS

COURSE OUTCOMES:

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

1. Explain Sequences, Limits, Tests of convergence and Rearrangements.
2. Derive the existence of the Riemann - Stieltjes integral.
3. Explain the properties of Integration and differentiationand rectifiable Curves.
4. Explain Uniform convergence of continuity, integrationand differentiation for sequences and series of functions.
5. Describe about the inverse function theorem,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 - Tests of convergence - Absolute convergence- Rearrangements.

UNIT – II

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

UNIT – III

SEQUENCES AND SERIES OF FUNCTIONS: Uniform convergence - power series- Weierstrass approximation theorem - Equicontinuity - Arzela-Ascoli theorem.

UNIT – IV

FUNCTIONS OF SEVERAL VARIABLES: Linear transformation – Differentiation– Theinverse function theorem – The implicit function theorem.

UNIT – V

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, 3.52 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
I	20PMA1CC2		REAL ANALYSIS			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(✓) = 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**	
26	**0**	**0**	**0**	**26**	**Global**

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

SEMESTER – I

Course Code: 20PMA1CC3 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE –III- ORDINARY DIFFERENTIAL EQUATIONS

COURSE OUTCOMES:

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

1. Construct convergent power series solutions to Ordinary differential equations
2. Evaluate the approximation solution of the Ordinary differential equations.
3. Recognize the solutions of LEGENDRE, EULER, and BESSEL equations
4. Model Problems in nature using Ordinary differential equations
5. Apply Ordinary differential equations in other disciplines.

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 – Non local existence of solutions-Approximations to and uniqueness of solutions

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 to8
UNIT – V	Chapter –5	Sections 2 to 8

REFERENCE:

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20PMA1CC3		ORDINARY DIFFERENTIAL EQUATIONS			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(✓) = 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**	
28	**0**	**0**	**0**	**28**	**Global**

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

SEMESTER – I

Course Code: 20PMA1CC4 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE –IV- CLASSICAL DYNAMICS

COURSE OUTCOMES:

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

1. Define mechanical system, Generalized Co-ordinates, Constraintsand 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.

UNIT – I

INTRODUCTORY CONCEPTS: The mechanical system- Generalized Coordinates - Constraints - Virtual work–D'Alemberts 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– Pfaffiandifferential form - The Hamilton-Jacobi equation – Jacobi's theorem- Modified Hamilton-Jacobi Equation - Separability– Liouville's system-Stackel's theorem.

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&PromodSharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
I	20PMA1CC4		CLASSICAL DYNAMICS			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(✓) = 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	**0**	**0**	**0**	**33**	**Global**

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

SEMESTER – I

Course Code: 20PMA1CC5 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

CORE COURSE –V - ADVANCED GRAPH THEORY

COURSE OUTCOMES:

1. This helps students to understand various parameters of Graph Theory with algorithms.
2. Discuss Operations on Bipartite Graphs and circuits and Define Trees, Cayley's Formula and Kruskal's and Prim's Algorithm.
3. Discuss Operations on Eulerian and Hamiltonian Graphs.
4. This stimulates the analytical mind of the students, enable them to acquire sufficient knowledge and skill in the subject that will make them competent in various areas of mathematics and Prove Vizing's theorem.
5. Derive some properties on Planargraphs.

UNIT –I

AN INTRODUCTION TO GRAPHS: Basic concepts – IsomorphismandAutomorphism –The pigeonhole principle and Turan'stheorem– Distance –Radius -Diameter andGirth – SubgraphsandIsometricsubgraphs –Operations on Graphs - The Adjacency - Incidence and Path matrices– Introduction to Algorithms – Breadth-first search Algorithm– Dijkstra's Algorithm – Ford's Algorithm.

UNIT – II

BIPARTITE GRAPHS: Characterisations of bipartite graphs – Trees– cut edges and cut vertices– Spanning trees and isometric trees– Cayley's Formula – Binary trees– Spanning tree Algorithm – Kruskal's Algorithm – Prim's Algorithm.

UNIT – III

EULERIAN AND HAMILTONIAN GRAPHS: Charecterisations of Eulerian Graphs –- Randomly Eulerian Graphs – Application –Algorithm – Fleury's Algorithm –Hamiltonian Graphs– Hamilton Cycle in Power Graphs and Line Graphs – Hamiltonian Sequences.

UNIT –IV

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.

UNIT – V

PLANAR GRAPHS: Planar Embedding– Euler's Formula – Maximum Planar Graphs– Geometric dual – Characterisations of Planar Graphs – DMP Planarity Algorithm– Colouring in Planar Graphs – Face Colouring.

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– 2	Sections 2.1 to 2.7
UNIT – III	Chapter–5	Sections 5.1 to 5.9
UNIT – IV	Chapter– 7	Sections 7.1 to 7.6, 7.8 to 7.13
UNIT – V	Chapter – 8	Sections 8.1 to 8.8

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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20PMA1CC5		ADVANCED GRAPH THEORY			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(✓) = 37Relationship: **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**	
51	**2**	**2**	**2**	**51**	**Global**

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

SEMESTER – II

Course Code: 20PMA2CC6 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE –VI- 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 isomorphicabelian groups.
3. Discuss the algebraic concepts of finite and infinite fields and its illustrations.
4. To find the splitting field, Galois group of the given polynomial.
5. Describe some of the canonical forms of linear transformations such as triangular,Hermitian, Unitary andnormal transformations.

UNIT – I

SYLOW'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: CanonicalForms- Triangular Form– Hermitian Unitary and Normal Transformation.

TEXT BOOK:

1. I.N.Herstein, Topics in Algebra, Second Edition, John wiely& sons New York, 1975.

UNIT – I	Chapter – 2	Sections 2.11 & 2.12
UNIT – II	Chapters – 2&3	Sections2.13, 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, Newyork, 2002.

2. M.Artin, "Algebra" Prentice-Hall of India Pvt. Ltd. 1991.
3. N.S.Gopala Krishnan, University Algebra,Second Edition, John wiely& sons (Asia) Pvt.Ltd, 1986.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
II	20PMA2CC6		ALGEBRA			6		5		
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**	
24	**0**	**0**	**0**	**24**	**Global**

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

SEMESTER – II

Course Code: 20PMA2CC7 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE –VII- COMPLEX ANALYSIS

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 intergrals.
2. Classify Removable singularities, Zeros and polesandDescribe the local mapping.
3. DemonstrateHomology 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-Taylors'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.

UNIT – V

CONFORMAL MAPPINGS:

Riemann mapping Theorem: Statement and Proof – Boundary Behaviour – Use of theReflection Principle.

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, 1979.

UNIT – I	Chapter – 4	Sections 1.4 to1.5, 2.1 to2.3.
UNIT – II	Chapter – 4	Sections 3.1 to3.4
UNIT – III	Chapter–4	Sections 4.1 to 4.7
UNIT – IV	Chapter –4	Sections 5.1 to 5.3, 6.1 to 6.3
UNIT – V	Chapter – 6	Sections 1.1 to 1.3, 2.1 to 2.3, 3.1 to3.2

REFERENCE(S):

1. H.A. Presfly, Introduction to complex Analysis, Clarendon Press, oxford, 1990.
2. John B. Corway, 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
II	20PMA2CC7		COMPLEX ANALYSIS			6		5	
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(✓) = 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	**1**	**1**	**1**	**31**	**Global**

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

SEMESTER – II

Course Code: 20PMA2CC8 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE –VIII - PARTIAL DIFFERENTIAL EQUATIONS

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 – Linear partial Differential Equations with constant coefficients– Equations with variable coefficients – Separation of variables– The method of Integral Transforms – Non linear equations of the second order.

UNIT- III

LAPLACE'S EQUATION : Elementary solutions of Laplace equation– Families of EquipotentialSurfaces – 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: Elementary Solutions of the Diffusion Equation – Separation of variables – The useofIntegralTransforms– The useofGreen'sfunctions.

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 3 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
II	20PMA2CC8		PARTIAL DIFFERENTIAL EQUATIONS			6		5		
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(✓) = 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**	
31	**3**	**3**	**3**	**31**	**Global**

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

SEMESTER – II

Course Code: 20PMA2EC1:1 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

ELECTIVE – 01 - MATHEMATICAL STATISTICS

COURSEOUTCOMES:

The student will be able to

1. Define Probability and the distribution function of a Random Variable.
2. Understand mathematical expectations, marginal and conditional distributions.
3. Understand the gamma, chi-square distributions, Sampling theory and Transformations of variables of the discrete and continuous type.
4. Understand the t & F distributions and their applications.
5. DescribeMoment generating function technique and the Central Limit Theorem.

UNIT – I

The probability set function – Random variables– Probability density function– Distribution function – Mathematical expectation – Special mathematical expectations – Chebyshev's Inequality.

UNIT – II

Conditional probability– Marginal and conditional distributions– Stochastic independence Some special distributions - The Binomial distribution - Trinomial and Multinomial distributions – The Poisson distribution.

UNIT – III

The Gamma and Chi-Square Distributions – The Normal distribution- The Bivariate normal distribution - Distributions of functions of random variables - Sampling theory – Transformations of variables of the discrete type– Transformations of variables of the continuous type.

UNIT – IV

The t and F distributions- Distributions of order statistics- The moment generating function technique - The distributions of $\bar{X}$ and nS^2/σ^2 - Expectations of functions of random variables.

UNIT – V

Limiting distributions -stochastic convergence- Limiting moment generating functions – The Central limit theorem – Some theorems on limiting distributions.

TEXT BOOK:

1. Robert V. Hogg and Allen T. Craig, Introduction to Mathematical Statistics, 4th edition.
   UNIT – I Chapter – 1 Sections 1.4 to 1.7, 1.9 to 1.11

UNIT – II	Chapters – 2 & 3	Sections 2.1 to 2.2, 2.4 & 3.1 to 3.2
UNIT – III	Chapters – 3 & 4	Sections 3.3 to 3.5 & 4.1 to 4.3
UNIT – IV	Chapter – 4	Sections 4.4, 4.6 to 4.9
UNIT – V	Chapter – 5	Sections 5.1 to 5.5

REFERENCE BOOKS:

1. M.Fisz, Probability theory and Mathematical statistics, John Wiley & sons, New York, 1963.
2. E.J.Dudewiczn and S.N.Mishra, Modern Mathematical Statistics, John Wiley & sons, New York, 1988.
3. V.N.Rohatgi, An introduction to Probability theory and Mathematical statistics, Wiley Eastern Limited, New Delhi, 1988.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
II	20PMA2EC1:1		MATHEMATICAL STATISTICS			6		5		
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**	
30	**0**	**0**	**0**	**30**	**Global**

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

SEMESTER – II

Course Code: 20PMA2EC1:2 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

ELECTIVE – 01 -PROBABILITY THEORY

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 theExpectation and Moments.
5. Understand the concept ofConvergence 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– Limits of random variables.

UNIT – II

PROBABILITY SPACE: Definition of probability – Some simple properties– Discrete probability space – General probability space– Induced 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 -Convergence theorems for Expectations.

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 FaridAitsahlia, Elementary Probability, Springer Verlag 2003, New York.
3. MarekCapinski and ThomaszZastawniak, 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
II	20PMA2EC1:2		PROBABILITY THEORY			6		5	
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 (✓) = 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	**Number of Topics**				**Category Based on %**
	Local	**Regional**	**National**	**Global**	

Topics					
22	**0**	**0**	**0**	**22**	**Global**

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

SEMESTER – II

Course Code: 20PMA2EC1:3 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

ELECTIVE - 01 -TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY

COURSE OUTCOMES:

This course will enable the students to:

1. Explain the basic concepts of tensors.
2. Learn various properties of Christoffel's symbols, Ricci Theorem - Riemann -Christoffel Tensor and their properties.
3. Understand the concept of Einstein Tensor, Riemannian and Euclidean Spaces.
4. Learn about Galilean Transformation and Lorentz Transformation equations.
5. AnalyseLagrangian and Hamiltonian formulations and Accelerated systems.
6.

UNIT - I

Invariance - Transformations of coordinates and its properties - Transformation by invariance - Transformation by covariance and contra variance -Covariance and contra variance - Tensor and Tensor character of their laws - Algebras of tensors - Quotient tensors - Symmetric and skew symmetric tensors –Relative tensors.

UNIT - II

Metric Tensor - The fundamental and associated tensors - Christoffel's symbols - Transformations of Chrisffel's symbols- Covariant Differentiation of Tensors - Formulas for covariant Differentiation- Ricci Theorem - Riemann Christoffel Tensor and their properties.

UNIT - III

Einstein Tensor- RiemannianandEuclidean Spaces (Existence Theorem)-The e-systems and the generalized Kronecker deltas - Application of the e-systems.

UNIT - IV

Special Theory of Relativity: Galilean Transformation - Maxwell's equations - The ether Theory – The Principle of Relativity Relativistic Kinamatics -Lorentz Transformation equations - Events and simultaneity - Example Einstein Train - Time dilation - Longitudinal Contraction -Invariant Interval - Proper time and Proper distance – World line - Examples - twin paradox - addition of velocities - Relativistic Doppler effect.

UNIT - V

Relativistic Dynamics : Momentum – energy – Momentum energy four vector – Force – Conservation of Energy – Mass and energy – Examples – inelastic collision – Principle of equivalence – Lagrangian and Hamiltonian formulations .

Accelerated Systems: Rocket with constant acceleration – Examples – Rocket with constant thrust.

TEXT BOOK(S):

1. I.S. Sokolnikoff, Tensor Analysis, John Wiley and Sons, New York, 1964
2. D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985

UNIT – I	Chapter – 2	Sections 18 to 28 of [1]
UNIT – II	Chapter – 2	Sections 29 to 37 of [1]
UNIT – III	Chapter – 2	Sections 38 to 41 of [1]
UNIT – IV	Chapter – 7	Sections 7.1 & 7.2 of [2]
UNIT – V	Chapter – 7	Sections 7.3 & 7.4 of [2]

REFERENCE(S):

1. J.L. Synge and A.Schild, Tensor Calculus, Toronto, 1949.
2. A.S. Eddington, The Mathematical Theory of Relativity, Cambridge University Press, 1930.
3. P.G. Bergman, An Introduction to Theory of Relativity, New York, 1942.
4. C.E. Weatherburn, Riemannian Geometry and Tensor Calculus, Cambridge, 1938.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
II	20PMA2EC1:3		TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY			6			5	
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 (✓) = 34 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	
51	4	4	4	51	Global

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

SEMESTER – II

Course Code: 20PMA2EC2:1
Instruction Hours: 6
Credits: 4

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

ELECTIVE – 02 - FUZZY SETS AND THEIR APPLICATIONS

COURSE OUTCOMES:

1. From 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 rankingmethods 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 andsub normal fuzzy sets – Support– Level sets - fuzzy points –αcuts – Decomposition Theorems - Extension Principle.

UNIT – II

OPERATION ON FUZZY SETS: Standard fuzzy operations – Union - intersection and complement– properties De. Morgan's laws

UNIT – III

FUZZY RELATIONS: Crisp and Fuzzy Relations– Projections andCylindric Extensions – Binary Fuzzy Relations – Binary Relations on a single set– Fuzzy Equivalence Relations - Fuzzy Compatibility Relations.

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 3.5
UNIT – III	Chapter – 5	Sections 5.1 to 5.8
UNIT – IV	Chapter –15	Sections 15.1 to 15.7
UNIT – V	Chapter – 17	Sections17.2 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).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
II	20PMA2EC2:1		FUZZY SETS AND THEIR APPLICATIONS			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(✓) = 38Relationship: **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	1	1	1	33	Global

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

SEMESTER – II

Course Code: 20PMA2EC2:2 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

ELECTIVE - 02 – CONTROL THEORY

COURSE OUTCOMES:

1. Discuss the basic concepts of Observability and illustrate the examples.
2. Students will be taught to master control probelms using central mathematical techniques such usOptimal Control and Matrix Riccati equation
3. Solve some basic control problems for nonlinear system that do not have a controllable linearized system.
4. Analyze the stabilization via linear feedback control.
5. Solve the matrix Riccati equations.

UNIT-I

OBSERVABILITY: LinearSystems– ObservabilityGrammian – Constant coefficient systems– Reconstruction kernel – Nonlinear Systems.

UNIT-II

CONTROLLABILITY: Linear systems– Controllability Grammian– Adjoint systems– Constant coefficient systems – Steering function– Nonlinear systems.

UNIT-III

STABILITY: Stability– Uniform stability– Asymptotic stability of linear systems - Linear time varying systems– Perturbed linear systems – Nonlinear systems.

UNIT-IV

STABILIZABILITY: Stabilization via linear feedback control – Bass method – Controllable subspace– Stabilization with restricted feedback.

UNIT - V

OPTIMAL CONTROL: Linear time varying systems with quadratic performance criteria– Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems.

TEXT BOOK:

1. K.Balachandran and J.P.Dauer, Elements of Control Theory, Narosa, New Delhi, 1999.

UNIT – I	Chapter – 2	
UNIT – II	Chapter – 3	Sections 3.1 to 3.3
UNIT – III	Chapter – 4	
UNIT – IV	Chapter – 5	
UNIT – V	Chapter – 6	

REFERENCE(S):

1. R.Conti, Linear Differential Equations and Control, Academic Press, London, 1976.
2. R.F.Curtain and A.J.Pritchard, Functional Analysis and Modern Applied Mathematics,Academic Press, New York, 1977.
1. J.Klamka, Controllability of Dynamical Systems, Kluwer Academic Publisher, Dordrecht,1991.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
II	20PMA2EC2:2		CONTROL THEORY			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 (✓) = 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	
25	0	0	0	25	Global

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

SEMESTER – II

Course Code: 20PMA2EC2:3 Exam Hours: 3

Instruction Hours: 6 Internal Marks: 25

Credits: 4 External Marks: 75

ELECTIVE – 02 - PROGRAMMING IN C++

COURSEOUTCOMES:

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
II	20PMA2EC2:3		PROGRAMMING IN C++			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 (✓) = 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: 20PMA3CC9 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE –IX- TOPOLOGY

COURSEOUTCOMES:

1. Define topological spaces and explain the properties oforder topology, product topology, subspace topology,continuous functions.
2. Describe the properties on metric topology
3. Gain the knowledge of connected spaces.
4. Apply domain knowledge for compact space with examples.
5. State and prove Urysohnlemma,UrysohnMetrization theorem and The Tietz Extension Theorem.

UNIT – I

TOPOLOGICAL SPACES: Topological spaces - Basis for a Topology - The order Topology – TheProduct Topology on X x 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: TheCountability Axioms - The separation Axioms - Normal spaces - The Urysohn Lemma - The UrysohnMetrization Theorem - The Tietz Extension Theorem.

TEXT BOOK:

1. James R. Munkres, Topology, Second Edition, Pearson Education Pvt. Ltd., New Delhi, 2003.
   - 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 Sections 30 to 35

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. 4. Seymour Lipschutz, Theory and Problems of General Topology, McGraw-Hill Edition,New Delhi (2006).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
III	20PMA3CC9		TOPOLOGY			6			5	
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**	
22	**0**	**0**	**0**	**22**	**Global**

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

SEMESTER –III

Course Code: 20PMA3CC10 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE - X – MATHEMATICAL METHODS

COURSEOUTCOMES:

1. Discuss regularity conditions and prove Fredholmalternative and Describe method of successive approximations and Volterra Integral.
2. Explain applications to ordinary differential equationsof Initial value boundary value problems and Illustrate and discuss singular integral equations to Abelintegral equation.
3. Gain the knowledge about fourier transforms and Parseval's Theorems.
4. Demonstrate Hankel transforms and its properties.
5. Describe calculus of variations and applications

UNIT – I

INTEGRAL EQUATIONS: Types of Integral equations – Integral Fredholm Alternative - Approximate method– Equation with separable Kernel - Volterra integral equations– Fredholm's theory.

UNIT – II

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 – III

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 – IV

HANKEL TRANSFORMS: Properties of Hankel Transforms – Hankel transformation of derivatives of functions - The Parseval's relation.

UNIT – V

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

TEXT BOOK(S):

1. Linear Integral Equations Theory and Technique by R.P.Kanwal, Academic Press, New York, 1971.
2. Vasishtha, Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2008.
3. Differential Equations and Calculus of Variations by L.Elsgolts, Mir Publishers, Moscow, 1970.

UNIT – I	Chapters–1 &2	Sections 1.1 – 1.7 & 2.3 - 2.5 of [1]
	Chapters – 3 & 4	Sections 3.3 - 3.4 & 4.1 - 4.5 of [1]
UNIT – II	Chapters – 5 & 8	Sections 5.1 – 5.3 & 8.1 - 8.2 of [1]
UNIT – III	Chapter – 6	Sections 6.1 – 6.21 of [2]
UNIT – IV	Chapter – 9	Sections 9.1 – 9.7 of [2]
UNIT – V	Chapter – 6	Sections 1, 2, 5 – 7of [3]

REFERENCE(S):

1. Integral Equations by Shanti Swarup, Krishna Prakashan Media Ltd, Meerut,1982.
2. I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
III	20PMA3CC10		MATHEMATICAL METHODS			6		5		
Course Outcomes (COs)	**ProgrammeOutcomesPOs)**					**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: 20PMA3CC11 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE – XI- NUMERICAL METHODS WITHMATLAB PROGRAMMING

COURSE OUTCOMES:

1. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. Apply numerical methods to obtain approximate solutions to mathematical problems.
3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
4. Analyse and evaluate the accuracy of common numerical methods.
5. Implement numerical methods in Matlab.
6. Write efficient, well-documented Matlab code and present numerical results in an informative way.
7. Solving interpolation and numerical integration in ordinary differential equationsinMatlab.

UNIT – I

MATLAB ENVIRONMENT: Getting Started– Solving Problems in MATLAB– Saving you works – Predefined MATLAB Functions – Using Predefined Functions – Manipulating Matrices– Computational Limitations-Special Values and Functions.

UNIT – II

PLOTTING: Introduction- Two Dimensional Plots– Three Dimensional Plotting – Editing Plots from the Menu Bar– Creating Plots from the Workshop Window

Programming in MATLAB: Introduction– Problems with Two Variables – Input/Functions – Statement level Control Structures.

UNIT – III

NUMERICAL TECHNIQUES: Introduction– Curve Fitting - Linear and Polynomial Regression – Using the Interactive Fitting Tools – Numerical Integration – Numerical Differentiation.

UNIT – IV

Curve Fitting– Linear and parabolic curves by the method of least squares principle- Solving algebraic and transcendental equations-Bisection method - false position method -Newton Raphson method – Solving simultaneous algebraic equation – Guassseidal method – Guass elimination method.

UNIT – V

Interpolation: Newton's forward and backward difference formulae– Lagrange's interpolation formulae – Numerical integration using Trapezoidal rule- Simpson's one third rules – solution of ODE's - Euler method –RungeKutta fourth order method.

TEXT BOOKS:

1. Delores M.Etter, David C.Kuncicky, Holly Moore. Introduction to MATLAB, Published by Dorling Kindersley (india) Pvt. Ltd., licenses of Pearson Education in South Asia.
2. M.K.Venkatraman, Numerical methods in Science and Engineering, National Publisher Company, Fifth Edition, 2001

UNIT–I	Chapters – 2 & 3	
UNIT–II	Chapters– 4 & 5	
UNIT–III	Chapter – 8	
UNIT– IV	Chapter–2	Sections 1.7 to1.8,
	Chapters –3 & 4	Sections 2, 4, 5&2, 6 of [2].
UNIT–V	Chapters –6& 8	Sections 3& 4
	Chapters – 9 & 11	Sections 8, 10 & 10,16 of [2]

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
III	20PMA3CC11		NUMERICAL METHODS WITH **MATLAB** PROGAMMING			6		5		
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**	
39	**0**	**0**	**0**	**39**	**Global**

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

SEMESTER –III

Course Code: 20PMA3EC3:1 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

ELECTIVE – 03 – OPTIMIZATIONTECHNIQUES

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 andits 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 – Optimal Subdividing Problem – Solution of Linear Programming Problem through Dynamic Programming.

UNIT- III

NON LINEAR PROGRAMMING: Introduction– Lagrangean Method–Jacobi method - Kuhn–Tucker Method – Quadratic Programming – Separable Programming – Chance–Constrained Programming orStochastic Programming.

UNIT- IV

INVENTORY: Introduction–Inventory Decisions – Cost Associated with Inventories – FactorsAffecting 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 – 17.6 of [2]
UNIT – IV	Chapter – 19	Sections 19.1, 19.2, 19.4, 19.6, 19.7, 19.9 – 19.13
	Chapter – 20	Sections 20.1, 20.2 of [1]
UNIT – V	Chapter – 21	Sections 21.1 – 21.4, 21.7, 21.9 of [1]

REFERENCE BOOKS:

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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
III	20PMA3EC3:1		OPTIMIZATION TECHNIQUES			6		5	
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**	
43	**1**	**1**	**1**	**43**	**Global**

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

SEMESTER – III

Course Code: 20PMA3EC3:2 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

ELECTIVE - 03 - METHODS OF MATHEMATICAL PHYSICS

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 Liouvilleproblem,Laguerre polynomials and Dirac Delta function.
4. Understood Non homogeneous boundary value problems and Eigen function expansion of Green's function.
5. Understood Green's function in higher dimensions and Wave equation with source.

UNIT - I

Boundary value problems and series solution - Examplesof boundaryvalue 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 - Fourier transform method of constructing 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 -Wave equation with source - the quantum mechanical scattering problem.

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 6.8

REFERENCE(S):

1. B.D. Gupta, Mathematical Physics, Vikas Publishing House Pvt Ltd, New Delhi, 1993.
2. GoyalAKGhatak, Mathematical Physics, Differential Equations and Transform Theory, McMillan India Ltd, 1995.
3. Kryzeg, Higher Engineering Mathematics.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
III	20PMA3EC3:2		METHODS OF MATHEMATICAL PHYSICS			6		5	
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**	

21	**1**	**1**	**1**	**21**	**Global**

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

SEMESTER – III

Course Code: 20PMA3EC3:3 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

ELECTIVE – 03 - DISCRETE MATHEMATICS

COURSE OUTCOMES:

Upon completion of this course the student will be able to

1. Construct mathematical arguments using logical connectives and quantifiers.
2. Understood The Pigeonhole Principle, Permutations and Combinations and Solving Linear Recurrence Relations.
3. Understand how Boolean algebra can be used as a tool and mathematical model in the study of networks.
4. Discuss about Coding theoryand its Properties.
5. Learn how to work with some of the discrete structures which include sets, relations, function and recurrence relation.

UNIT –I

THE FOUNDATIONS: LOGIC & PROOFS: Propositional Logic- Applications of Propositional Logic- Propositional Equivalences- Predicates and Quantifiers– Nested Quantifiers Algorithms - The Growth of Functions

UNIT– II

COUNTING & ADVANCED COUNTING TECHNIQUES: The Basics of Counting- The Pigeonhole Principle- Permutations and Combinations - Generalized Permutations and Combinations - Generating Permutations and Combinations - Applications of Recurrence Relations- Solving Linear Recurrence Relations - Generating Functions

UNIT–III

BOOLEAN ALGEBRA & MODELING COMPUTATIONS: Boolean Functions- Representing Boolean Functions - Logic Gates- Minimization of Circuits - Finite State machines with Output - Finite State machines with No Output - Turing Machines.

UNIT – IV

CODING THEORY: Introduction to Coding- Linear Codes- Cyclic codes- Special Cyclic codes

UNIT– V

FURTHER APPLICATIONS OF ALGEBRA: Semi group- Semigroup and Automata - Semigroup and formal Languages- Linear Recurring sequences.

REFERENCE(S):

1. Kenneth H. Rosen, Discrete Mathematics and it's Applications, 7th Edition/ McGraw Hill Education, New York, 2012 Units I, II, III.
2. Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra 2nd Edition Springer, 1997 Units IV &V .
3. J.P. Tremblay & R. Manohar, A First Course in Discrete Structures with Applications to Computer Science, McGraw Hill, 1987.
4. T. Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hills Publishing Company Limited, 7th Reprint, 2008
5. Liu C.L, Elements of Discrete Mathematics, McGraw Hill, New York, 1978
6. Grimaldi R.P and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, 2004

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
III	20PMA3EC3:3		DISCRETE MATHEMATICS			6		5		
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 (✓) = 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	
29	2	2	2	29	Global

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

SEMESTER – III

Course Code: 20PMA3EC4:1 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

ELECTIVE – 04 - STOCHASTIC PROCESSES

COURSEOUTCOMES:

1. Describe stability of a Markov Systemandlimiting 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/1 and G/M/1 Queues -Network of Queues

UNIT - V

Standard Brownian motion -Brownian motionand 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).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
III	20PMA3EC4:1		STOCHASTIC PROCESSES			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(✓) = 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 – III

Course Code: 20PMA3EC4:2 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

ELECTIVE – 04 - COMBINATORICS

COURSE OUTCOMES:

This course will enable the students to

1. Understand the concept of structure of permutations.
2. Discuss the different type of generating function.
3. Solve Recurrence Relation and Linear Recurrence Relations with Constant coefficients solutions by the technique of generating functions.
4. Learn toThe principle of inclusion and exclusion,permutations with forbidden positions.
5. State and ProvePolya' s fundamental theorem and generation of Polya's theorem.

UNIT - I

Permutations and Combinations - Distributions of distinct objects -Distributions of non distinct objects – Stirlings formula.

UNIT - II

Generating functions - Generating function for Combinations - Enumerators for Permutations -distributions of distinct objects into non-distinct cells - Partitions of integers – The Ferrer's graphs - Elementary relations.

UNIT - III

Recurrence Relation- Linear Recurrence Relations with Constant coefficients solutions by the technique of generating functions -a special class of nonlinear difference equations - Recurrence Relations with two indices.

UNIT - IV

The principle of inclusion and exclusion -General formula - Permutations with restriction on relative positions - derangements - the rook polynomials - permutations with forbidden positions.

UNIT - V

Polya's theory of counting - equivalence classes under a permutation group Burnside theorem - equivalence classes of functions- weights and inventories of functions-Polya' s fundamental theorem – generation of Polya's theorem.

TEXT BOOK:

1. C.L. Liu, Introduction of Combinatorial Mathematics, McGraw Hill,1968.

UNIT – I	Chapter – 1
UNIT – II	Chapter – 2
UNIT – III	Chapter – 3
UNIT – IV	Chapter – 4
UNIT – V	Chapter – 5

REFERENCE(S):

1. Marshall Hall Jr, Combinatorial Theory,SecondEdition,John Wiley & Sons.
2. H.J. Rayser, Combinatorial Mathematics, Carus Mathematical Monograph, No.14.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
III	20PMA3EC4:2		COMBINATORICS			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 (✓) = 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**	
27	**0**	**0**	**0**	**27**	**Local**

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

SEMESTER – III

Course Code: 20PMA3EC4:3 Exam Hours: 3

Instruction Hours: 6 Internal Marks: 25

Credits: 4 External Marks: 75

ELECTIVE – 04 - AUTOMATA THEORY

COURSEOUTCOME:

1. The learner gain knowledge of fundamental concepts of automata.
2. Properties of regular languages push down automata and context free languages.
3. The learner gain knowledge to Pushdown Automaton.
4. Discuss Role of a lexical analyzer and its Properties.
5. Understood Parsers, Bottom up Parsers, Top down Parsers, Recursive descent and Predictive parsers.

UNIT – I

FINITE AUTOMATA AND REGULAR EXPRESSIONS: Definitions andExamples-Deterministic and Nondeterministic finite Automata-Finite Automata with moves.

UNIT –II

CONTEXT FREE GRAMMAR: Regular expressions and their relationship with automation– Grammar-Ambiguous and unambiguous grammars- Derivation trees– Chomsky Normal form.

UNIT – III

PUSHDOWN AUTOMATON: Pushdown Automaton- Definition andExamples- Relation with Context free Languages.

UNIT – IV

FINITE AUTOMATA AND LEXICAL ANALYSIS: Role of a lexical analyzer - Minimizing the number of states of a DFA-Implementation of a lexical analyzer.

UNIT – V

BASIC PARSING TECHNIQUES: Parsers- Bottom up Parsers-Shift reduce- operator precedence - Top down Parsers -Recursive descent- Predictive parsers.

TEXTBOOKS:

1. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata theory, Languages and Computations, Narosa Publishing House, Chennai, 2000.
2. A.V. Aho and Jeffrey D. Ullman, Principles of Compiler Design, Narosa Publishing House, Chennai, 2002.

UNIT – I	Chapter – 2	Sections 2.1 – 2.4 [1]
UNIT – II	Chapter – 2& 4	Sections 2.5 & 4.1- 4.3, 4.5-4.6 [1]
UNIT – III	Chapter –5	Sections 5.2 -5.3 [1]
UNIT – IV	Chapter –3	Sections 3.1 – 3.8 [2]
UNIT – V	Chapter – 5	Sections 5.1 – 5.5 [2]

REFERENCE(S):

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall, 1997.
2. A.V. Aho, Monica S. Lam, R. Sethi, J.D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Addison-Wesley, 2007.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
III	20PMA3EC4:3		AUTOMATA THEORY			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 (✓) = 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**	
21	**2**	**2**	**2**	**21**	**Global**

SEMESTER – IV

Course Code: 20PMA4CC12 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE - XII – FUNCTIONAL ANALYSIS

COURSEOUTCOMES:

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 -Examplesand some related basic results– Regular and singular elements– 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 65 & 67 to 68

REFERENCE(S):

1. Walter Rudin, Functional Analysis, TMH Edition, 1974.
2. BalmohanV. Limaye, Functional Analysis, Second Print, Wiley Eastern Limited, Bombay, 2005.
3. M. Thamban Nair, Functional Analysis, A First Course, Prentice Hall of India, 2002.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
IV	20PMA4CC12		FUNCTIONAL ANALYSIS			6		5	
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(✓) = 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**	
29	**1**	**1**	**1**	**29**	**Global**

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

SEMESTER – IV

Course Code: 20PMA4CC13 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 5 External Marks: 75

CORE COURSE - XIII – DIFFERENTIAL GEOMETRY

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 asurface, 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- Involutes and Evolutes- Intrinsic equations - Fundamental Existence Theorem for space curves- Helices.

UNIT - II

Intrinsic Properties of a Surface: Definition of a surface - curves on a surface - Surface of revolution - Helicoids – MetricDirection 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 9
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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
IV	20PMA4CC13		DIFFERENTIAL GEOMETRY			6		5	
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**	
35	**0**	**0**	**0**	**35**	**Global**

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

SEMESTER – IV

Course Code: 20PMA4EC5:1 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

ELECTIVE - 04 – ALGEBRAIC NUMBERTHEORY

COURSE OUTCOMES:

This course will enable the students to learn

1. Demonstrate Algebraic congruence,Primitive roots and theory of Indicices.
2. Prove Euler Function and its Properties.
3. Understand the concept of Farey Sequence, Continued Fractions and Pell's Equation.
4. Methods and techniques used in number theory
5. Demonstrate Knowledge and understanding of topics including, but not limited to divisible the congruences quadratic reciprocity.

UNIT - I

ALGEBRAIC CONGRUENCE AND PRIMITIVE ROOTS: Algebraic Congruence - Reduction of $f(x) \equiv 0(mod\ m)$- Primitive Roots - Theory of Indices.

UNIT - II

ARITHMETIC FUNCTIONS: Arithmetic Functions – Euler's Function – Divisor Function – The Function of σ - The Function $\sigma_k(n)$ The Mobius Function $\mu(n)$-The Function $P(n) = \prod_{d/n} d$.

UNIT - III

Farey Sequence – Continued Fractions – Notion of Convergents and Infinite Continued Fractions - Applications to Equations.

UNIT - IV

Quadratic Irrationals– Pell's Equation – Fibbonaci Numbers.

UNIT - V

Quadratic Residues - Legendre's Symbol –Quadratic Reciprocity Law - Quadratic Residue for Composite Modules: Jacobi's Symbol.

TEXTBOOK:

1. K.C. Chowdhury, A First Course in Theory of Numbers, Asian Books Pvt. Ltd., New Delhi, 2004.

UNIT – I	Chapter – 3	Sections 3.1, 3.3 & 3.4
UNIT – II	Chapter – 4	Sections 4.1 to 4.5
UNIT – III	Chapter – 5	Sections5.1 to 5.3
UNIT – IV	Chapter – 5	Sections5.5 to 5.7
UNIT – V	Chapter – 6	Sections 6.1 to 6.4

REFERENCE(S):

2. S.B.Malik, Basic Number Theory, Second Edition, Vikas Publishing House Pvt. Ltd., Noida,2009.
3. George E. Andrews, Number Theory, Courier Dover Publications, 1994.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
IV	20PMA4EC5:1		ALGEBRAIC NUMBER THEORY			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(✓) = 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**	
22	**1**	**1**	**1**	**22**	**Global**

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

SEMESTER – IV

Course Code: 20PMA4EC5:2 Exam Hours: 3
Instruction Hours: 6 Internal Marks: 25
Credits: 4 External Marks: 75

ELECTIVE – 05 - 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-arbitragepricing 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 Boxter 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 FarancoisMantion), Introduction to Stochastic Calculus Applied to Finance, Chapman and Hall, 1996.
3. MarekMusiela 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).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
IV	20PMA4EC5:2		FINANCIAL MATHEMATICS			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(✓) = 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 – IV

Course Code: 20PMA4EC5:3
Instruction Hours: 6
Credits: 4

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

ELECTIVE – V- FLUID DYNAMICS

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 andsteady 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 equationof 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 – sphericalharmonics– axially symmetric field – Stoke's stream function – motion of a sphere – pressuredistribution– 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 Couetteflow 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
IV	20PMA4EC5:3		FLUID DYNAMICS			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(✓) = 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 – IV

Course Code: 20PMA4CP1 Exam Hours: 3

Instruction Hours: 6 Internal Marks: 40

Credits: 4 External Marks: 60

CORE PRACTICAL – 01- NUMERICAL METHODSWITH MATLAB PROGRAMMING (P)

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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
IV	20PMA4CP1		NUMERICAL METHODS WITH MATLAB PROGRAMMING(P)			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 (✓) = 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	**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 2020-2021 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 multifaceted 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.
- 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 2020

Semester	Course Code	Course	Course Title	No. of Hours	Credit	CIA Marks	SE Marks	Total Marks
I	20MPMA1CC1	Core-I	Research Methodology	6	4	40	60	100
	20MPMA1CC2	Core-II	Analysis and Applied Mathematics	6	4	40	60	100
	20MPMA1CC3	Core-III	Teaching and Learning Skills	6	4	40	60	100
	20MPMA1CC4	Core-IV	Paper on Topic on Research (To be Framed by the Guide)	6	4	40	60	100
			Total	**24**	**16**	**160**	**240**	**400**
II	20MPMA2DW	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

I Review : 20 Marks

II Review : 20 Marks

Evaluation of Project : 120 Marks

Viva Voce : 40 Marks

SEMESTER – I

Course Code: 20MPMA1CC1 Exam Hours: 3
Instruction Hours:6 Internal Marks: 40
Credits: 4 External Marks: 60

CORE-I - RESEARCH METHODOLOGY

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 $\llcorner^{p}$- Riesz representation Theorem.

UNIT – V

Homotopy of paths – The Fundamental group – Covering spaces--The Fundamantal Group of the circle – Retractions and fixes Points – the fundamental theorem of algebra - the BorsukUlam Theorem – Deformation Retracts and Homotopy Type.

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 55 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 53 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).

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20MPMA1CC1		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**	
25	**0**	**0**	**0**	**25**	**Global**

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

SEMESTER – I

Course Code: 20MPMA1CC2 Exam Hours: 3
Instruction Hours:6 Internal Marks: 40
Credits: 4 External Marks: 60

CORE-II – ANALYSIS AND APPLIED MATHEMATICS

COURSE OCTCOMES:

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 Directed graphs and domination number of graph, Exploration and Stratification.
4. Illustrate the Nonlinear Programming Algorithms.
5. Illustrate the Fuzzy Graph: Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees

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 – Applicationof theformular$(x) = \lim \| x \|$- Involution in Banach Algebra - The Gelfand Neumark 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: Directed Graphs – Independent Sets & Matching – Graph Coloring.

UNIT – IV

Operations Research: Nonlinear Programming Algorithms - Unconstrained Algorithms – Constrained Algorithms.

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. Hamdy A. Taha, Operations Research an Introduction, Eighth Edition, Prentice Hall, Delhi.
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 68&70 to 73 of [1]
UNIT – II	Chapters–1 & 2	Sections 1.1 to 1.7 & 2.1 to 2.2 [2]
UNIT – III	Chapters – 2,5 & 7	Sections 2.1 to 2.3, 5.1 to 5.4 & 7.1 to 7.5 of [3]
UNIT – IV	Chapter – 19	Sections 19.1 to 19.2.2 [4]
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).
3. KantiSwaroop, Gupta.P.K,&Manmohan, Operations Research, Sultan Chand & Co, 16th Revised Edition.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**	
I	20MPMA1CC2		ANALYSIS AND APPLIED MATHEMATICS			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(✓) =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**	
31	**2**	**2**	**2**	**31**	**Global**

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

SEMESTER – I

Course Code: 20MPMA1CC3 Exam Hours: 3
Instruction Hours:6 Internal Marks: 40
Credits: 4 External Marks: 60

CORE-III – TEACHING LEARNING SKILLS

COURSEOUTCOMES:

1. Develop skills of ICT and apply them in teaching learning context andResearch and Appreciate the role of ICT in teaching, learning and Research.
2. Acquire the knowledge of communication skill with special reference to itselements, types, development and styles.
3. Understand the terms communication Technology and Computer mediatedteaching 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 targetedaudience.

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 forcompetency building; individual learning for professional development usingprofessional 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.

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**		**Credits**		
I	20MPMA1CC3		TEACHING LEARNING SKILLS			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**	
33	**0**	**0**	**0**	**33**	**Global**

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

SEMESTER – I

Course Code: 20MPMA1CC4 | Exam Hours: 3
Instruction Hours:6 | Internal Marks: 40
Credits: 4 | External Marks: 60

CORE IV: OPERATIONS RESEARCH

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: Dynamic Programming

Elements of the DP Model - The Capital Budgeting- More on the Definition of the state - Examplesof DPmodels andcomputations - Problem of Dimensionality in Dynamic programming- Solution of Linear programs by Dynamic programming.

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 (Fifth Edition - 1996) H.A.Taha, Prentice Hall of India (P) Limited, New Delhi, 1996.

UNIT – I	Chapter – 10
UNIT – II	Chapter – 12
UNIT – III	Chapter – 14
UNIT – IV	Chapter – 15
UNIT – V	Chapter – 19 & 20

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

Relationship Matrix for COs, POs and PSOs

Semester	**Code**		**Title of the Course**			**Hours**			**Credits**	
I	20MPMA1CC4		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(✓) = 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	**3**	**3**	**3**	**25**	**Local**

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