# **ALAGAPPA UNIVERSITY**

# **M.Sc., MATHEMATICS**

Syllabus (Affiliated Colleges)

**AUGUST 2023** 

NEW INITIATIVE IN MODERNISING POST-GRADUATE PROGRAMME IN MATHEMATICS AUGUST 2023

# **Programme Outcomes:**

**PO1: Disciplinary Knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of anPost graduate programme of study.

**PO2: Critical Thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

**PO3: Problem Solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

**PO4: Analytical & Scientific Reasoning:** Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

**PO5:** Research related skills: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned researchperspective; Sense of inquiry and capability for asking relevant questions / problem arising / synthesizing / articulating / ability to recognize cause and effect relationships / define problems. Formulate hypothesis, Test / analyse / Interpret the results and derive conclusion, formulation and designing mathematical models

**PO6: Self-directed & Lifelong Learning:** Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

# **Programme Specific Outcomes:**

**PSO1:** Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

**PSO2:** Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

**PSO3:** To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions.

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

To encourage practices grounded in research that comply with employment laws, leading the organization towards growth and development.

**Mapping of Course Learning Outcomes (CLOs)** with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)can be carried out accordingly, assigning the appropriate level in the grids:

			PC	)s	PSC				
	1	2	3	4	5	6	 1	2	
CLO1									
CLO2									
CLO3									
CLO4									
CLO5									

				Semester - I						
Sem	Part	<b>Course Code</b>	Courses	List of Courses	Г/ Р	Credit	Hours/	M	ax. Ma	arks
							week	Int.	Ext.	Total
		23MMA1C1	CC – 1	Algebraic Structures	Т	4	5	25	75	100
		23MMA1C2	CC-2	Real Analysis - I	Т	4	5	25	75	100
		23MMA1C3	CC - 3	Ordinary Differential						
				Equations	Т	4	5	25	75	100
		23MMA1E1/		Number Theory and						
		23MMA1E2/	DSE- I	Cryptography /						
	Part A	23MMA1E3/		Graph Theory and	т	2	5	25	75	100
				Applications /		5	5	23	/5	100
				Formal Languages and						
				Automata theory						
		23MMA1E4/	DSE- II	Mathematical Programming /						
		23MMA1E5/		Fuzzy sets and their						
т		23MMA1E6/		Applications /						
1				Discrete Mathematics	T	3	5	25	75	100
		23MMA1SP	SEC-I	Office Automation		_	_			
	Part B			(Internal Paper)	P	2	3	25	75	100
		23MMA1AP	AECC-I	Mathematics for Competitive						
				Examinations - I	_			25	75	1.0.0
				(Internal Paper)	P	2	2			100
				lotal	-	22	30	175	525	700
			00.4	Semester - II	<b>_</b>	4	~	25	7.5	100
		23MMA2C1	CC - 4	Advanced Algebra	T	4	5	25	75	100
		23MMA2C2	CC-5	Real Analysis - II	T	4	5	25	75	100
		23MMA2C3	CC-6	Partial Differential Equations	T	4	5	25	75	100
		23MMA2E1/		Algebraic Geometry /						
		23MMA2E2/	DSE-III	Mathematical Statistics /	<b>—</b>	2		25	7.5	100
	Dout	23MMA2E3		l ensor Analysis and		3	5	25	/5	100
	r art A		DOE IV	Relativity						
	1	23MMA2E4/	DSE-IV	Laterral Equations (Wayalata						
		23MMA2E3/		Machina Learning and						
		25WIWIAZE0		Artificial Intelligence	т	2	5	25	75	100
		22MM 4 25D	SEC II	Mathematical	1	5	5	23	15	100
		231v11v1A25F	SEC-II	Documentation using	D	2	3	25	75	100
П					1		5	23	15	100
	Part	23ΜΜΔ2ΔΡ	AECC-II	Mathematics for						
	B	231VIIVIA2AI		Competitive				25	75	
				Examinations - II	Р	2	2		, , , ,	100
				Total	-	22	30	175	525	700

# Credit Distribution for PG Programme M.Sc Mathematics- Programme Structure

				Semester - III						
		23MMA3C1	CC-7	Complex Analysis	Т	4	5	25	75	100
		23MMA3C2	CC-8	Probability Theory	Т	4	5	25	75	100
	Part	23MMA3C3	CC-9	Topology	Т	4	5	25	75	100
	A	23MMA3C4	CC-10	Industrial Statistics	Т	3	5	25	75	100
		23MMA3E1/	DSE- V	Algebraic Number Theory /						
		23MMA3E2/		Fluid Dynamics /	Т	3	5	25	75	100
		23MMA3E3		Stochastic Processes						
		23MMA3SP	SEC-III	MATLAB an Introduction	Р	2	3	25	75	100
	Part	23MMA3AP	AECC-III	Subjective Skills in	Р	2	2	25	75	100
	B			Mathematics - I				25	/5	100
		23MMA3I		Internship / Industrial						
				Activity						
TTT				(Carried out in Summer		2	-	25	75	100
111				Vacation at the end of I year						
				– 30 hours						
				Total		24	30	200	600	000
				Total	-	24	50	200	000	000
				Semester - IV	-	24	50	200	000	800
		23MMA4C1	CC-11	Semester - IV Functional Analysis	- T	4	5	200	75	100
		23MMA4C1 23MMA4C2	CC-11 CC-12	Semester - IV           Functional Analysis           Differential Geometry	T T	4 4	5 5 5	200 25 25	75 75	100 100
		23MMA4C1 23MMA4C2 23MMA4C3	CC-11 CC-12 CC-13	Semester - IV         Functional Analysis         Differential Geometry         Mechanics	T T T	4 4 4	5 5 5 5	200 25 25 25	75 75 75 75	100 100 100
	Part	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR	CC-11 CC-12 CC-13 CC-14	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voce	- T T 	4 4 4 3	5 5 5 4	25 25 25 25 25	75 75 75 75 75	100 100 100 100
	Part A	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/	CC-11 CC-12 CC-13 CC-14 Electiv	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced Numerical	T T T 	4 4 4 3	5 5 5 4	25 25 25 25 25	75 75 75 75 75	100 100 100 100
IV	Part A	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/	CC-11 CC-12 CC-13 CC-14 Electiv e VI	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /	- T T  T	4 4 4 3 3	5 5 5 4 5	25 25 25 25 25 25 25	75 75 75 75 75 75	300           100           100           100           100           100           100
IV	Part A	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/ 23MMA4E3	CC-11 CC-12 CC-13 CC-14 Electiv e VI	FortalSemester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /Algebraic Topology /	T T T- T	4 4 4 3 3	5 5 5 4 5	25 25 25 25 25 25	75 75 75 75 75 75	100           100           100           100           100           100           100
IV	Part A	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/ 23MMA4E3	CC-11 CC-12 CC-13 CC-14 Electiv e VI	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /Algebraic Topology /Financial Mathematics	T T T  T	4 4 4 3 3	5 5 5 4 5	25 25 25 25 25 25	75 75 75 75 75 75	300           100           100           100           100           100           100           100
IV	Part A	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/ 23MMA4E3 23MMA4E3	CC-11 CC-12 CC-13 CC-14 Electiv e VI SEC-IV	FortalSemester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /Algebraic Topology /Financial MathematicsMathematical Economics	- T T  T P	4 4 4 3 3 2	5 5 5 4 5 4	25 25 25 25 25 25 25 25 25	75 75 75 75 75 75 75	300           100           100           100           100           100           100           100           100           100
IV	Part A Part	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/ 23MMA4E3 23MMA4E9 23MMA4SP 23MMA4AP	CC-11 CC-12 CC-13 CC-14 Electiv e VI SEC-IV AECC-	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /Algebraic Topology /Financial MathematicsMathematical EconomicsSubjective Skills in	- T T  T P P	4       4       3       3       2       2       2	5       5       4       5       4       2	25 25 25 25 25 25 25 25 25 25	75 75 75 75 75 75 75 75 75	300           100           100           100           100           100           100           100           100           100           100
IV	Part A Part B	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/ 23MMA4E3 23MMA4E3 23MMA4SP 23MMA4AP	CC-11 CC-12 CC-13 CC-14 Electiv e VI SEC-IV AECC-IV	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /Algebraic Topology /Financial MathematicsMathematical EconomicsSubjective Skills inMathematics - II	T T T T P P	$\begin{array}{c} 2 \\ 4 \\ 4 \\ 3 \\ 3 \\ \hline 2 \\ 2 \\ \end{array}$	5           5           4           5           4           2	25 25 25 25 25 25 25 25 25 25	75           75           75           75           75           75           75           75           75           75           75	300           100           100           100           100           100           100           100           100           100
IV	Part A Part B	23MMA4C1 23MMA4C2 23MMA4C3 23MMA4PR 23MMA4E1/ 23MMA4E2/ 23MMA4E3 23MMA4E3 23MMA4E9 23MMA4AP	CC-11 CC-12 CC-13 CC-14 Electiv e VI SEC-IV AECC-IV	Semester - IVFunctional AnalysisDifferential GeometryMechanicsCore Project with viva voceAdvanced NumericalAnalysis /Algebraic Topology /Financial MathematicsMathematical EconomicsSubjective Skills inMathematics - IIExtension Activity	T T T T P P	$\begin{array}{c} 2 \\ 4 \\ 4 \\ 3 \\ 3 \\ \hline 2 \\ 2 \\ 1 \\ \end{array}$	5 5 5 4 5 4 2 -	25 25 25 25 25 25 25 25 25 25 25	75 75 75 75 75 75 75 75 75 75	100       100       100       100       100       100       100       100       100       -

## **TOTAL CREDITS: 91**

**Chairperson Details:**Dr.KE.Sathappan, Associate Professor, Department of Mathematics, Alagappa Govt. Arts College, Karaikudi. Mobile No:9444173696.

Title of the	Course	ALGEBRAIC STRUCTURES									
Paper Nun	ıber	CORE I									
Category	Core	Year	Ι	Credits	lits 4 Course 23MMA1C1						
		Semester	Ι			Code					
Instruction	al Hours	Lecture	T	utorial	Lab Prac	tice	Total				
per week		4	4 1 5								
Pre-requisi	ite	UG level M	odern	Algebra							
Objectives	of the	To introduc	e the	concepts ar	nd to develo	op work	ting knowledge of	on			
Course		class equation	on, sol	lvability of	groups, fin	nite abe	lian groups, line	ear			
		transformation	ons, re	al quadratic	forms						
UNIT-I		Counting Pri	inciple	- Class equ	ation for fin	nite grou	ips and its				
		applications	- Sylo	w's theorem	s (For theorem	rem 2.12	2.1, First proof				
		only).									
		Chapter 2: S	Section	ns 2.11 and	2.12 (Omi	t Lemm	na 2.12.5)				
UNIT-II		Solvable gro	ups - I	Direct produ	icts - Finite	abelian	groups- Modules	S			
		Chapter 5 :	Sectio	on 5.7 (Lem	ma 5.7.1,	Lemma	5.7.2, Theorem	1			
		5.7.1)	~			• •					
		Chapter 2: Section 2.13 and 2.14 (Theorem 2.14.1 only)									
		Unapter 4: Section 4.5									
UNIT-III		Linear Transformations: Canonical forms – Triangular form -									
		Nilpotent tra	nsforn	nations.							
		Chapter 6: S	Section	ns 6.4, 6.5	-1.6						
UNII-IV		Jordan form	- ratio	nal canonic	al form.						
		Chapter 6:	Sectio	ons 6.6 and	0./						
UNII-V		Trace and tra	anspos a farma	e - Hermilia	in, unitary,	normal	transformations,				
		Chantar (	C IOIIII		1 and 6 11	(Omit	( 0)				
Extandad	Professional	Questions r	Secul	to the abo	vo topios	from V	0.9)	ivo			
Component	(is a part of	Questions to		$C / T \mathbf{P} \mathbf{R} / \mathbf{N}$	VE TOPICS,		GATE / TNDS	sc			
internal	(is a part of	/ others to be	s OI S' s colve	d		- CSIN	/ UAIL / INIS	30			
only Not to	be included	(To be discu	ssed di	u uring the Tu	itorial hour	)					
in the	External		bbeu u	uning the re		)					
Examinatio	n question										
paper)	question										
Skills acqui	red from this	Knowledge.	Prob	olem Solvi	ng, Analvi	tical ab	ility, Profession	nal			
course		Competency	, Profe	essional Cor	nmunicatio	n and T	ransferrable Skill	1			
Recommen	ded Text	I.N. Herstei	n. Top	ics in Algeb	ra (II Editio	on) Wile	ey Eastern Limite	ed,			
		New Dell	ni, 197	5.		,	,	7			

<b>Reference Books</b>	1. M.Artin, Algebra, Prentice Hall of India, 1991.
	2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract
	Algebra (II Edition) Cambridge University Press, 1997. (Indian
	Edition)
	3. I.S.Luther and I.B.S.Passi, <i>Algebra</i> , Vol. I–Groups(1996); Vol.
	II Rings, Narosa Publishing House , New Delhi, 1999
	4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of
	Abstract Algebra, McGraw Hill (International Edition), New
	York. 1997.
	5. N.Jacobson, <i>Basic Algebra</i> , Vol. I & II W.H.Freeman (1980);
	also published by Hindustan Publishing Company, New Delhi.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, www.algebra.com

**Course Learning Outcome (for Mapping with POs and PSOs)** Students will be able to

- **CLO 1:** Recall basic counting principle, define class equations to solve problems, explain Sylow's theorems and apply the theorem to find number of Sylow subgroups.
- **CLO 2:** Define Solvable groups, define direct products, examine the properties of finite abelian groups, define modules.
- **CLO 3:** Define similar Transformations, define invariant subspace, explore the properties of triangular matrix, to find the index of nilpotence to decompose a space into invariant subspaces, to find invariants of linear transformation, to explore the properties of nilpotent transformation relating nilpotence with invariants.
- **CLO 4:** Define Jordan, canonical form, Jordan blocks, define rational canonical form, define companion matrix of polynomial, find the elementary devices of transformation, apply the concepts to find characteristic polynomial of linear transformation.
- **CLO 5:** Define trace, define transpose of a matrix, explain the properties of trace and transpose, to find trace, to find transpose of matrix, to prove Jacobson lemma using the triangular form, define symmetric matrix, skew symmetric matrix, adjoint, to define Hermitian, unitary, normal transformations and to verify whether the transformation in Hermitian, unitary and normal\.

				PSOs					
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the	Course	REAL ANALYSIS - I									
Paper Nu	mber				C	ORE II					
Category	Core	Year	Ι		Credits	4	Cou	irse	23MMA1C2		
		Semester	Ι				Cod	le			
Instruction	al	Lecture		Tuto	orial	Lab Pract	tice	Tota	ıl		
Hours per	week	4 1 5									
Pre-requisi	te	UG level real analysis concepts									
Objectives	of the	To work comfortably with functions of bounded variation, Riemann-									
Course		Stieltjes In	tegrat	tion, c	convergence	e of infinite	serie	s, infi	nite product and		
		uniform c	conver	rgence	e and its	interplay	betwo	een v	arious limiting		
		operations		Cour	a Outlina						
		Functions	of	Lour how	se Outline nded varie	tion - Int	rodu	rtion	- Properties of		
		monotonic	funct	tions	- Functions	of bounded	l vari	ation -	- Total variation		
		- Additive	prop	ertv o	of total vari	iation - To	tal van	riation	1 on [a, x] as a		
		function c	of x -	· Fun	ctions of	bounded v	variat	ion ex	xpressed as the		
		difference	of t	wo ii	ncreasing f	unctions -	Con	tinuou	is functions of		
UNI	Г-І	bounded v	ariatic	on.	C						
		Chapter –	6: Sec	tions	6.1 to 6.8						
		Infinite Se	eries:	Abso	lute and co	nditional co	onverg	gence	- Dirichlet's test		
		and Abel'	and Abel's test – Rearrangement of series- Riemann's theorem on								
		conditionally convergent series.									
		Chapter 8:	Chapter 8: Sections 8.8, 8.15, 8.17, 8.18								
		The Riemann - Stieltjes Integral - Introduction - Notation - The									
		Integration	of the	e Rie	mann - S	tieltjes inte	in o	- Line	ear Properties -		
		integration	Dodu	parts-	to a Pior	n variable	in a	Ful	nann - Stielijes		
LINIT	TT 1	formula -	Mon	otoni	cally incre	asing integ	grator	- Euro s Un	oper and lower		
UNII	-11	integrals -	Addi	tive a	nd linearity	v properties	of ur	oper. 1	ower integrals -		
		Riemann's	condi	ition -	Compariso	on theorems	5. 5.	· · · · ·	e wer mitegruis		
		Chapter - 7	7: Sec	tions	7.1 to 7.14		-				
		1									
		The Riem	ann-S	Stielt	jes Integra	l - Integra	tors of	of bou	inded variation-		
		Sufficient	condi	tions	for the exi	stence of F	Riema	nn-Sti	eltjes integrals-		
		Necessary	cond	itions	for the ex	sistence of	RS i	ntegra	lls- Mean value		
		theorems -	integr	als as	s a function	of the inte	rval -	- Seco	nd fundamental		
UNIT	ш	theorem of	f integ	gral c	alculus-Cha	ange of var	iable	-Seco	nd Mean Value		
UNII	-111	Theorem f	for Ri	eman	n integral-	Riemann-S	tieltje	es inte	grals depending		
		on a paran	neter-	Diffe	rentiation u	inder integr	al sig	n-Leb	esgue criteriaon		
		tor existen	ce of	Kiem	ann integra	ls. Chapter	- / : '	/.15 to	) /.26		

	Infinite Series and infinite Products - Double sequences - Double
	series - Rearrangement theorem for double series - A sufficient
	condition for equality of iterated series - Multiplication of series -
	Cesaro summability - Infinite products.
UNIT-IV	Chapter - 8 Sec, 8.20, 8.21 to 8.26
	<b>Power series</b> - Multiplication of power series - The Taylor's series
	generated by a function - Bernstein's theorem - Abel's limit theorem -
	Tauber's theorem
	Chapter 9: Sections 9.14, 9.15, 9.19, 9.20, 9.22, 9.23
	Sequences of Functions – Pointwise convergence of sequences of
	functions - Examples of sequences of real - valued functions - Uniform
	convergence and continuity - Cauchy condition for uniform
	convergence - Uniform convergence of infinite series of functions -
	Riemann - Stielties integration - Non-uniform Convergence and Term-
UNIT-V	hysterm Integration - Uniform convergence and differentiation -
	Sufficient condition for uniform convergence of a series - Mean
	convergence
	Chapter $-9$ Sec 9.1 to 9.6 9.8 9.9 9.10 9.11 9.13
Extended	Questions related to the above topics from various competitive
Professional	examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /
Component (is a part	others to be solved
of internal	(To be discussed during the Tutorial hour)
component only	(10 be discussed during the Futorial nour)
Not to be included in	
the External	
Examination	
question paper)	
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
this course	Competency, Professional Communication and Transferrable Skill
Recommended	Tom M.Apostol : <i>Mathematical Analysis</i> , 2 <sup>nd</sup> Edition, Addison-
Text	Wesley Publishing Company Inc. New York, 1974.
Reference Books	1. Bartle, R.G. <i>Real Analysis</i> , John Wiley and Sons Inc., 1976.
	2. Rudin.W. Principles of Mathematical Analysis, 3 <sup>rd</sup> Edition. McGraw
	Hill Company, New York, 1976.
	3. Malik, S.C. and Savita Arora. <i>Mathematical Anslysis</i> , Wiley Eastern
	Limited.New Delhi, 1991.
	4. Sanjay Arora and Bansi Lal, Introduction to Real Analysis, Satya
	Prakashan, New Delhi, 1991.
	5. Gelbaum, B.R. and J. Olmsted, Counter Examples in Analysis,
	Holden day, San Francisco, 1964.
	6. A.L.Gupta and N.R.Gupta, <i>Principles of Real Analysis</i> . Pearson
	Education, (Indian print) 2003.
Website and	http://mathforum.org. http://ocw.mit.edu/ocwweb/Mathematics.
e-Learning Source	http://www.opensource.org, www.mathpages.com

Students will be able to

CLO1: Analyze and evaluate functions of bounded variation and Rectifiable Curves.

CLO2: Describe the concept of Riemann-Stieltjes integral and its properties.

CLO3: Demonstrate the concept of step function, upper function, Lebesgue function and their integrals.

**CLO4:** Construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem.

CLO5: Formulate the concept and properties of inner products, norms and measurable functions.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of t Course	he	ORDINARY DIFFERENTIAL EQUATIONS									
Paper Nu	ımber			C	ORE III						
Category	Core	Year	Ι	Credits	4	Co	urse	23MMA1C3			
		Semester	I								
Hours	181	Lectur	<u>e</u>	lutorial	Lab Prac	ctice		lotal			
per week		4 1 5									
Pre-requis	ite	UG level (	Calculus	and Different	tial Equatio	ns					
Objectives	of the	To devel	op stroi	ig backgrou	nd on fir	nding	solu	tions to linear			
Course		differential	equation	ns with cons	tant and va	riable	coeff	icients and also			
		with singu	lar points	, to study ext	istence and	uniqu	leness	of the solutions			
		of first ord	er differ	ential equatio	ns						
		Linear equ	LUC Lations v	vith constant	coefficien	ts					
		Second or	der hom	ogeneous ed	uations-Ini	tial v	alue 1	oroblems-Linear			
UNI	T-I	dependenc	e and	independenc	e-Wronski	an a	nd a	í formula for			
		Wronskian-Non-homogeneous equation of order two.									
		Chapter 2: Sections 1 to 6									
		Linear equations with constant coefficients									
TINIT	г н	Homogeneous and non-homogeneous equation of order n –Initial value									
UNI	1-11	problems- Annihilator method to solve non-homogeneous equation-									
		Algebra of constant coefficient operators. Chapter 2: Sections 7 to 12									
		Linear equ	ation w	ith variable	coefficients	5					
		Initial valu	e proble	ns -Existence	e and uniqu	eness	theor	ems – Solutions			
		to solve	a non-h	omogeneous	equation	– W	ronsk	ian and linear			
UNIT	<b>-III</b>	dependenc	e – redu	ction of the	order of a	ı hom	ogene	eous equation –			
		homogeneo	ous equ	ation with	analytic	coeffi	cients	-The Legendre			
		equation.	0	. 1 4. 9 ( 0	• • • • • • • • • • • • • • • • • • • •	0)					
		Linear equ	Section w	<u>5 1 10 8 ( Ull</u> ith regular s	ingular noi	9) ints					
		Euler equa	tion $-$ Se	cond order e	auations wi	ith reg	ular s	singular points –			
		Exceptiona	ul cases –	Bessel Func	tion.		, and t	ingului pointo			
UNI	Γ <b>-ΙV</b>	Chapter 4	: Section	ns 1 to 4 and	6 to 8 (Or	nit se	ctions	5 and 9)			
		Existence a	and uniqu	eness of solu	tions to firs	st orde	er equ	ations: Equation			
		with varia	ble sepa	rated – Exa	ct equation	1 – n	nethoo	1 of successive			
UNI	Γ-V	approxima	tions –	the Lipschi	tz conditic	n –	conv	ergence of the			
		successive	approxi	hations and the $(1)$	ne existence	theor	rem.				
		Chapter 5	: Section	18 I TO 6 ( <b>O</b>	mit Sectior	18 / to	) 7)				

Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC / TRB / NET / UGC - CSIR / GATE / TNPSC /
Component (is a part	others to be solved
of internal	(To be discussed during the Tutorial hour)
component only,	
Not to be included in	
the External	
Examination	
question paper)	
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
this course	Competency, Professional Communication and Transferrable Skill
Recommended	E.A.Coddington, A introduction to ordinary differential equations (3 <sup>rd</sup>
Text	Printing) Prentice-Hall of India Ltd., New Delhi, 1987.
<b>Reference Books</b>	1. Williams E. Boyce and Richard C. DI Prima, Elementary
	differential equations and boundary value problems, John Wiley
	and sons, New York, 1967.
	2. George F Simmons, Differential equations with applications and
	historical notes, Tata McGraw Hill, New Delhi, 1974.
	3. N.N. Lebedev, Special functions and their applications, Prentice
	Hall of India, New Delhi, 1965.
	4. W.T. Reid. Ordinary Differential Equations, John Wiley and Sons,
	New York, 1971
	5. M.D.Raisinghania, Advanced Differential Equations, S.Chand&
	Company Ltd. New Delhi 2001
	6. B.Rai, D.P.Choudary and H.I. Freedman, A Course in Ordinary
	Differential Equations, Narosa Publishing House, New Delhi,
	2002.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, www.mathpages.com

Students will be able to

CLO1: Establish the qualitative behavior of solutions of systems of differential equations .

**CLO2:** Recognize the physical phenomena modeled by differential equations and dynamical systems.

**CLO3:** Analyze solutions using appropriate methods and give examples.

CLO4: Formulate Green's function for boundary value problems.

**CLO5:** Understand and use various theoretical ideas and results that underlie the mathematics in this course.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course	NUMBER THEORY AND CRYPTOGRAPHY									
Paper Number										
Category DSE-IA	Year	Ι	Credits	3	Course	23MMA1E1				
	Semester	Ι	Creatis	5	Code	2314114121				
Instructional Hours	Lecture	T	utorial	Lab Prac	tice	Total				
per week	4	4   1								
Pre-requisite	UG level N	UG level Number Theory								
Objectives of the	To introduce the concepts and to develop working knowledge on									
Course	Greatest Common Divisor, factorization, linear Diophantine equations,									
	quadrance residues Legendre symbols and The idea of Public Key Cryptography									
Cryptography.										
Course Outline										
	Introduction	1 - W	ell Orderin	g – Induct	ion- Bino	mial Coefficients-				
UNIT-I	Greatest int	teger t	unctions-	Jivisibility-	Greatest	Common Divisor				
	(GCD) - E	uclid's	algorithm	– GCD V18	e Euclid	s algorithm- Least				
	(Chapter 1	unipie 8-2. So	(LCIVI) - Ief	$\sim 1.6.22$ to	<b>2 4</b> of To	s. vt hooly 1)				
	Introduction	$\underline{\mathbf{x}}_{-\text{nrim}}$	es countino	o 1.0, 2.2 to trunction -	nrime nu	nber theorem- test				
	of primality	of primality - canonical factorization fundamental theorem of								
UNIT-II	arithmetic Seive of Eratosthenes Determining factorization-									
	fundamental theorem of arithmetic- Seive of Eratosthenes determining									
	canonical factorization of a natural number.									
	(Chapter 3	:Section	ons 3.1 to 3	.3of Text bo	ook 1)					
	Congruence- equivalence relations-linear congruences -linear									
UNIT-III	Diophantine	e equa	ations-Chin	ese remair	nder theo	rem- polynomial				
	congruences	5 - 1	modular a	rithmeticFe	rmat's th	eorem –Wilson's				
	theorem- Fermat number.									
	(Chapter 4	:Section	ons 4.2-4.7	of Text boo	KI)	a daa at aa aa daa ti a				
UNIT-IV	Arithmetic	iuncui andra d	ons- tau tu	nctions- Di	I out of re	oduci – quadratic				
	residuesLegendre symbols- Gauss lemma- Law of reciprocity.									
	Cryptograph	$\frac{\alpha}{100}$	oduction- S	Some simple	e crypto sv	stems-Encinhering				
	MatricesThe	e idea	of Public k	ev Cryptog	aphy – R	SA - Discrete log-				
UNIT-V	Knapsack					8				
	(Chapter 3	(Chapter 3 &4 :Sections3.1- 3.2, 4.1-4.4 of Text book -2)								
Extended Professional	Questions 1	elated	to the ab	ove topics,	, from va	rious competitive				
Component (is a part of	examination	s UPS	C / TRB / 1	NET / ŪGC	– CSIR /	GATE / TNPSC /				
internal component	ient others to be solved									
only, Not to be included	(To be discu	be discussed during the Tutorial hour)								
in the External										
Examination question										
paper)				•	• • •	1				
Skills acquired from this	Knowledge	, Pro	blem Solv	ing, Analy	vtical abi	lity, Professional				
course	Competency	7, Profe	essional Con	nmunication	n and Tran	sterrable Skill				

<b>Recommended Text</b>	1. Neville Robbins, Beginning Number Theory, second Edition,								
	Narosa, 2006.								
	. Neal Koblitz, A Course in Number Theory and								
	Cryptography, Second edition, Springer-Verlag Newyork-1994.								
<b>Reference Books</b>	1. Tom. M. Apostol, Introduction to analytic Number theory, Naro								
	Publishing House,1998.								
	2. Ivan Nivan, H.S.Zuckerman and H.L.Montgomery, An introduction								
	to the theory of Number, 5th Ed paperback- International Edition,								
	1991.								
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,								
e-Learning Source	http://www.opensource.org, www.mathpages.com								

Students will be able to

- **CLO 1:** Learn the Well Ordering, Greatest integer functions, Divisibility, Greatest Common Divisor, Euclid's algorithm and Least Common Multiple.
- **CLO 2:** Define the primes counting function, prime number theorem, canonical factorization fundamental theorem of arithmetic, Seive of Eratosthenes Determining factorization fundamental theorem of arithmetic and Seive of Eratosthenes determining canonical factorization of a natural number.
- **CLO 3:** Form the equivalence relations, linear congruences, linear Diophantine equations, Chinese remainder theorem, polynomial congruences and understand about modular arithmetic Fermat's theorem and Wilson's theorem, Fermat number.
- **CLO 4:** Definearithmetic functions and tau functions, Legendre symbols to understand the Gauss lemma- Law.
- **CLO 5:** Understand the simple crypto systems, Enciphering Matrices, the idea of Public key Cryptography and RSA.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	1	3	3	3	3	2	2
CLO2	2	3	2	1	3	3	3	2	2
CLO3	1	3	2	3	3	3	3	2	2
CLO4	3	2	3	3	3	3	3	2	2
CLO5	2	3	2	2	3	3	3	2	2

Title of the Course	GRAPH THEORY AND APPLICATIONS									
Paper Number										
Category DSF_I R	Year	Ι	Credits	3	Cours	se 23MMA1F2				
Category DSE-1D	Semester	Ι	Creatis	5	Code					
<b>Instructional Hours</b>	Lecture	T	utorial	Lab Prac	tice	Total				
per week	4	4   1   5								
Pre-requisite	UG level C	Graph Tł	neory							
<b>Objectives of the</b>	To introduce the concepts and to develop working knowledge on Cut									
Course	edges and cut vertices, Euler Tours, Perfect Matchings, Edge chromatic									
	number, Independent sets, Chromatic number, Planar Graph and Eular									
	formula.	~								
			rse Outline		<u><u> </u></u>					
	Graphs, S	Subgrap	bhs : Gra	iphs and	Simple	Graphs – Graph				
UNIT-I	Isomorphi	sm - 1n	le Incidenc	e and Adja	cency N	latrices – Subgraphs				
	- vertex D	egrees	– Paths an Voutions	a Connecti Corriguese	on Cyci	es. Trees- Cut Eages				
	and Bond Sections 1	15- Cul 1 to 1 7	2 1  to  2 4	- Cayley's	Form	una. (Chapter 1&2:				
	Connectivit	<u>1 to 1.7</u> tv Euler	. Tours And	Hamilton (	Tycles: (	Connectivity_				
UNIT-II	Blocks- Fuler tours – Hamilton cycles: Connectivity –									
	(Chapter 3	&4: Sec	ctions 3.1 t	ns 3.1 to 3.2, 4.1 to 4.2						
	Matchings – Matchings Coverings in Binartite Graphs – Perfect									
	Matching. Edge colourings: Edge Chromatic Number – Vizing's									
UNIT-III	Theorem.									
	(Chapter 5&6: Sections 5.1 to 5.3,6.1 to 6.2)									
	T 1 1			1 0	( D					
	Independent Sets, Cliques: Independent Sets- Ramsey's Theorem									
UNIT IV	Conjecture	Chron	Unromatic .	Number – B	orook S I	Theorem – Hajos				
UI <b>II-I</b> V	Conjecture – Chromatic Polynomials – Girth and Chromatic Number.									
	(Chapter 7&8: Sections 7.1 to 7.3, 8.1 to 8.5)									
	Plane and F	Planar G	raphs – Dua	al Graphs –	Euler's	Formula- Bridges –				
	Kuratowski	i's Theo	rem (Proof	Omitted) –	The Five	e Colour Theorem				
UNIT-V	and The Four Colour Conjecture – Nonhamiltonian Planar Graphs –									
	Directed G	raphs: D	irected Gra	phs – Direc	ted Path	s – Directed Cycle				
	(Chapter 9	&10: S	ections 9.1	to 9.7 , 10.1	to 10.3					
Extended Professional	Questions	related	to the at	pove topics	, from	various competitive				
Component (is a part of	examination	ns UPS	C / TRB / 1	NET / UGC	C - CSII	R / GATE / TNPSC /				
internal component	ient others to be solved									
only, Not to be included	(To be discussed during the Tutorial hour)									
in the External										
Examination question										
paper)	Vnowlada	D <sub>ma</sub> 1	alam Cal-	ing An-1	vtice1	ability Drafagioral				
Skills acquired from this	Competence	t, Profe	ssional Cor	munication	yucai	autility, rrolessional				
UNIT-III UNIT-IV UNIT-V Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) Skills acquired from this course	Theorem. (Chapter 5 Independen VertexColo Conjecture (Chapter 7 Plane and F Kuratowski and The Fo Directed Gr (Chapter 9 Questions examination others to be (To be disc	<b>5&amp;6: Sec</b> at Sets, Courings: – Chron <b>2&amp;8: Sec</b> <b>Planar G</b> <b>i's Theo</b> <b>ur Colouraphs: D</b> <b>2&amp;10: Sec</b> related ns UPSC <b>e solved</b> ussed du <b>e</b> , Prol y, Profe	ctions 5.1 to Cliques: Ind Chromatic natic Polyn ctions 7.1 to raphs – Dua rem (Proof ur Conjectu Pirected Gra ections 9.1 to the ab C / TRB / 2 uring the Tu	<b>b 5.3,6.1 to</b> ependent Se Number – B omials – Gin <b>o 7.3, 8.1 to</b> al Graphs – Omitted) – re – Nonhar phs – Direc <b>to 9.7, 10.1</b> ove topics NET / UGC atorial hour)	6.2) ets- Ram prook's T rth and ( 8.5) Euler's T The Five niltonian ted Path to 10.3 c, from C – CSII	nsey's Theorem Theorem – Hajos Chromatic Number. Formula- Bridges – e Colour Theorem n Planar Graphs – s – Directed Cycle yarious competitive R / GATE / TNPSC / ability, Professional ansferrable Skill				

<b>Recommended Text</b>	J.A.Bondy and V.S.R.Murty, Graph Theory and applications,										
	Macmillan, London, 1976.										
<b>Reference Books</b>	1. S.A.Choudum, A First Course in Graph Theory, Macmillan, India										
	Ltd., 1987.										
	2. R.Balakrishnan and K.Renganathan, A Text Book of Graph Theory,										
	Springer Verlag, New York, 1999.										
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,										
e-Learning Source	http://www.opensource.org, www.mathpages.com										

Students will be able to

**CLO 1**: Define Graph and Subgraph, explain the adjacency and incidence matrix. Define tree and develop the respective theorems.

CLO 2: Define Connectivity Euler Tours And Hamilton Cycles.

**CLO 3:** Matchings Coverings in Bipartite Graphs, Perfect Matching are defined. Define Edge Chromatic Number and Vizing's Theorem.

- **CLO 4:** Define Independent Sets and Cliques, Ramsey's Theorem, Brook's Theorem, Hajos Conjecture, Chromatic Polynomials ,Girth.
- **CLO 5:** Define Plane, Planar Graphs, Dual Graphs, Euler's Formula- Bridges, The Five Colour Theorem, The Four Colour Conjecture, Nonhamiltonian Planar Graphs are defined. Define directed Graphs, directed Paths, directed Cycle.

		POs						PSOs	
	1	2	3	4	5	6	1	2	3
CLO1	3	2	1	3	3	3	3	2	1
CLO2	2	2	3	3	3	3	3	2	1
CLO3	3	3	2	3	3	3	3	2	1
CLO4	1	3	2	3	3	3	3	2	1
CLO5	3	1	3	3	3	3	3	2	1

Title of th	ne Course	FORMAL LANGUAGES AND AUTOMATA THEORY									
Paper N	Number				-			-			
Catagory	DSEIC	Year	Ι	Credits	3	Course Cod	e	23MM			
Category	DSE-I C	Semester	Ι		5		_	A1E3			
Instructiona	l Hours	Lecture	T	<b>`utorial</b>	]	Lab Practice	Total				
per week		4		1		5					
Pre-requisit	e	UG level set theory and Logic									
Objectives o	f the	To introduce the concepts and to develop working knowledge on									
Course		Finite automata, regular sets, free grammars, normal forms and									
		Turing mach	nines	5.							
		(	Coui	rse Outline							
		Finite autom	nata	and Regular	expre	ssions - Finite st	ate svst	ems –			
		Basic definit	tions	s – Nondete	rminist	tic finite automa	ta – Fin	ite			
UNIT-I		automata wi	th ε	moves – Re	gular o	expressions – Re	egular				
		grammars.			C	1	0				
		(Chapter 2.	Sec	tions 2.1 to	2.5 C	hapter 9 Section	n 9.1)				
		Properties of	f reg	ular sets. T	he Pun	nping lemma for	regular	sets –			
UNI	T_II	Closure properties of regular sets – Decision algorithms for regular									
	1-11	sets – The Myhill-Nerode Theorem and minimization of finite									
		automata.									
		(Chapter 3	: Se	ctions 3.1 to	<u>o 3.4)</u>						
		Context-free	e gra	mmars -Mo	tivatio	n and introducti	on – Co	ntext-			
UNI	Г-III	free grammars – Derivation treesSimplification of context-free									
		grammars – Chomsky normal form – Greibach normal form.									
		(Chapter 4	: Se	ction 4.1 to	4.6)		D	.1.1			
LINIT	т њу	Pushdown a	uton	nata- inform	ial des	cription- Definit	10ns-Pu	sndown			
UNI	1-1V	dotorministi		shdown out	inguag	es – Normai Ior	ins for				
		(Chapter 5 : Sections 5 1 to 5 3)									
		Properties of	$\frac{1}{1}$	text_free la	nguage	es The numning	lemma	for			
		CFL's - Clo	sure	nonerties	for CF	L's – Decision a	loorith	ns for			
UNI	T-V	CFL's. Intro	duct	tion to Turi	ng Mac	chines The Turir	ng mach	ine –			
		Programmin	g te	chniques for	r Turin	g machines.	8				
		(Chapter 6	& 8	: Sections 6	5.1 to 6	.3, 8.2, 8.3)					
Extended	Professional	Questions re	elate	ed to the at	ove to	opics, from vari	ious con	mpetitive			
Component	(is a part of	examination	s U	PSC / TRI	3 / N	ET / UGC – C	CSIR /	GATE /			
internal com	ponent only,	TNPSC / oth	TNPSC / others to be solved								
Not to be inc	cluded in the	(To be discu	issed	l during the	Tutori	al hour)					
External	Examination										
question pape	er)										
Skills acquir	ed from this	Knowledge	, Pr	oblem Sol	ving,	Analytical abili	ty, Pro	fessional			
course		Competency	v, Pro	ofessional C	Commu	inication and Tra	ansferra	ble Skill			

Recommended Text	John E.Hopcraft and Jeffrey D.Ullman, Introduction to Automata
	Theory, Languages and Computation, Narosa Publishing House,
	New Delhi, 1987.
<b>Reference Books</b>	1. A. Salomaa, Formal Languages, Academic Press, New York,
	1973.
	2. John C. Martin, Introduction to Languages and theory of
	Computations (2nd Edition) Tata- McGraw Hill Company Ltd.,
	New Delhi, 1997
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, www.mathpages.com

Students will be able to

- **CLO 1:** Define Finite automata, regular expressions, Basic definitions of Nondeterministic finite automata, Finite automata with ε moves and Regular expressions.
- **CLO 2:** Examine the properties of regular sets, Pumping lemma for regular sets, Closure properties of regular sets, to explain the decision algorithms for regular sets.
- **CLO 3:** AnalyzetheContext-free grammars and Derivation trees, simplification of context-free grammars. To derive the Chomsky normal form and Greibach normal form.
- **CLO 4:** Define the Pushdown automata and context-free languages. To learn the Normal forms for deterministic pushdown automata.
- **CLO 5:** Understand about the pumping lemma for CFL's, closure properties for CFL's, Decision algorithms for CFL's. To learn the Turing machine concepts.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	1	3	3	3	3	2	1
CLO2	2	3	3	2	3	3	3	2	1
CLO3	1	3	2	1	3	3	3	2	1
CLO4	2	1	2	3	3	3	3	2	1
CLO5	3	2	3	2	3	3	3	2	1

Title of th	e Course		MATHEMATICAL PROGRAMMING									
Paper Nu	nber											
Catagory	DSE- II	Year	Ι	Cuadita	3	Cours	se	23MMA1E4				
Category	A	Semester	Ι	Credits		Code						
Instruction	nal	Lecture	Tut	orial	Lab Prac	tice [	Fota	l				
Hours per	week	4		1				5				
Pre-requis	site	UG Level ]	UG Level Linear Programming									
Objectives	s of the	To work	To work the Integer linear programming, Dynamic programming, Goal									
Course		programmi	programming, Non-linear programming and Simulations.									
			С	ourse Outl	ine							
		Integer Line	ar Progra	mming :								
		Types of Inte	per Lineau	· Programm	ing Proble	ms – Co	once	ept of Cutting Plane –				
UNIT	<b>`-I</b>	Gomory's All	Integer (	Lutting Plan	e Method -	– Gome	orv's	Mixed Integer				
		Cutting Plane	Joinory's All Integer Cutting Plane Method – Gomory's Mixed Integer									
		7.6)	memou	Dianon and	Dound m	emou (	Cina					
		Dvnamic Pro	grammir	ng:								
		ntroduction – Dynamic programming Terminology – Developing optimal										
UNIT	-11	lecision policy – Dynamic programming under certainty – Dynamic										
		programming approaches for solving Linear programming problem. (Chanter										
		22: Section 2	2.1 to 22.	5)				8				
		Goal Program	mming:	/								
		Difference be	tween LP	and GP app	oroach – C	oncept	of G	oal Programming –				
UNIT-	·III	Goal Program	ming Mo	del formula	tion – Gra	phical s	olut	ion method of Goal				
		Programming.										
		(Chapter 8 :	Section 8	.1 to 8.5)								
		Non linear D		ing Motho	da .							
		Inon-Intear P	rogramm The con		us : in con macor		~	ablam Craphical				
		Introduction -	- The gen	erai non – i Instis mus sur	inear prog		g pr	oblem – Graphical				
UNIT-	-IV	solution method - Quadratic programming – Applications of Quadratic										
		programming	Saatian (	1 1 40 24 5	`							
		(Chapter 24:	Section 4	24.1 10 24.5	)							
		Simulation:										
		ntroduction – Definition Simulation – Types of Simulation – Steps of										
		simulation pro	imulation process – Advantages and Disadvantages of Simulation – Stochastic									
UNIT	-V	Simulation an	imulation and Random Numbers –									
		Simulation in	ventory p	roblems – S	imulation	of Quei	ing	problems –				
		Simulation of	PERT pr	oblems.								
		(Chapter 19:	Section 1	19.1 to 19.8	and 19.11	.)						

Extended	Questions related to the above topics, from various competitive examinations
Professional	UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
Component (is a	(To be discussed during the Tutorial hour)
part of internal	
component only,	
Not to be	
included in the	
External	
Examination	
question paper)	
Skills acquired	Knowledge, Problem Solving, Analytical ability, Professional Competency,
from this course	Professional Communication and Transferrable Skill
Recommended	J.K.Sharma, Operations Research, (Fifth edition) Macmillan, New Delhi, 2013.
Text	
<b>Reference Books</b>	1. Hamdy A. Taha, Operations Research – An Introduction, Eighth
	Edition, Prentice-Hall, New Delhi, 2012.
	2. Kanti Swarup, Manmohan and P. K. Gupta, Operations Research,
	Sultan Chand &Co., 2006
	3. Kambo, Mathematical Programming Techniques, East –West
	Publications, Delhi, 1991.
	4. J. C. Pant, Introduction to Operations Research, Jain Brothers, 2008.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning	http://www.opensource.org, www.mathpages.com
Source	

Students will be able to

**CLO1:** Learn and solve the Integer Linear Programming Problems, Gomory's Mixed Integer Cutting Plane Method, Branch and Bound Method.

**CLO2:** Solve and create the Dynamic programming Terminology, Dynamic programming under certainty and Dynamic programming approaches for solving Linear programming problem.

CLO3: Understand and learn about the Goal Programming, Graphical solution method of Goal Programming.

**CLO4:** get knowledge in Non – linear programming problem, Graphical solution method, Quadratic programming and Applications of Quadratic programming.

**CLO5:** get idea in Simulation, Steps of simulation process, Advantages and Disadvantages of Simulation, Stochastic Simulation and Random Numbers and Simulation of PERT problems.

	POs						PSOs		
	1	1 2 3 4 5 6						2	3
CLO1	1	3	3	2	3	3	3	2	1
CLO2	2	3	1	2	3	3	3	2	1
CLO3	3	2	1	3	3	3	3	2	1
CLO4	1	2	3	3	3	3	3	2	1
CLO5	2	1	2	3	3	3	3	2	1

Title of the	Course	FUZZY SETS AND THEIR APPLICATIONS							
Paper Num	ber				-				
Category	DSE-II B	Year	Ι	Credits	3	Cou	rse	23MMA1E5	
Category		Semester	I			Code			
Instruction	al Hours	Lecture	Tutorial		Lab Pract	tice	Total		
per week		$\frac{4}{100} - 5$							
Pre-requisi	te	UG level Fi	$\frac{1}{1}$	t theory	1 4 1	1	1 F	( F	
Objectives	of the	10 introdu	To introduce the concepts and to develop the Fuzzy sets,						
Course				reasure, ryp	bes of uncer	tanny	and r	uzzy system.	
				st Outline					
LINI	T _ I	Fuzzy Rela Basic conce	tions:	fuzzy sets –	Crisp verse	s fuzz	zy rela	tions – Binary	
	1 - 1	fuzzy relati	ons – B	sinary relation	ons on singl	e set	– Fuzz	zy equivalence	
		relations – I		compatibility	y relations -	- Fuzz	zy ord	ering relations.	
		(Chapter :	1 & 5	Sections I	.3, 1.4, 5.1,	5.3 to	0 5.7 0	of Text Book I)	
		Fuzzy Mea	sure:	Daliafar	. 1 Dlava:1.:1	: 4		a Duch chiliter	
TINI		measures –	Possib	ility and Ne	cessity mea	ny m sures	– Rel	s – Probability	
UN	11-11	Classes of f	uzzv m	leasures.		54105	Iten	attenship attens	
		(Chapter 4: Sections 4.1 to 4.5 of Text Book 2)							
		Uncortaint	v and l	Information	· ·				
LINIT	г ш	Type of Uncertainty – Measures of fuzziness – Classical measures of							
UNI	1 – 111	uncertainty – Measures of dissonance - Measures of confusion.							
		(Chapter 5	: Secti	ons 5.1 to 5	5.5 of Text	Book	2)		
		Fuzzy Syst	ems:						
		General dis	cussion	n – Fuzzy co	ntrollers – I	Fuzzy	v syste	ms and Neural	
UNI	T-IV	Network –	Fuzzy l	Neural Netw	vorks - Fuz	zy At	itomat	a – Fuzzy	
		dynamic systems.							
		(Chapter 12: Sections 12.1 to 12.7 of Text Book 1)							
		Fuzzy Deci	sion M	laking:					
		General Dis	cussion	n – Individu	al decision	maki	ng – N	Iultiperson	
UN	IT-V	decision ma	iking –	Multicriteri	a decision 1	nakin	g - M	ultistage	
		decision ma	iking –	Fuzzy rank	ing method.		aalt 1)		
		(Chapter I	5: Sect	10ns 15.1 to	0 15./ 01 1e	XT B	00K I)	)	
Extended	Professional	Questions	related	to the ab	ove topics,	fron	n vari	ious competitive	
Component	(is a part of	examination	1S UPS		NET / UGC	-CS	SIK / C	JATE / TNPSC /	
only Not to	be included	(To be disci	solved	uring the Ti	itorial hour	)			
in the	External		isseu u	uning the T		)			
Examination	n question								
paper)	1								
Skills acqui	red from this	Knowledge	e, Pro	blem Solv	ing, Analy	ytical	abili	ty, Professional	
course		Competence	y, Profe	essional Con	nmunicatio	n and	Trans	sferrable Skill	

Recommended Text	<ul> <li>1.George J. Klir and Bo Yuan, <i>Fuzzy sets and Fuzzy logic(Theory and applications)</i>, PHI Publications, 2010.</li> <li>2.George J. Klir and Tina A. Floger, <i>Fuzzy sets, Uncertainty and Information</i>, PHI Publications, 2007.</li> </ul>
<b>Reference Books</b>	1. A.Kaufman, Introduction to the Theory of Fuzzy Subsets,
	Academic Press, 1975.
	2.H.J.Zimmermann, Fuzzy Set Theory and its Applications, Allied
	Publishers, Chennai, 1996.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	https://cours.etsmtl.ca/sys843/REFS/Books/ZimmermannFuzzySetTh
	eory2001.pdf
	https://www.mdpi.com/books/pdfdownload/book/4344

Students will be able to

- **CLO 1:** Know theconcepts of fuzzy sets, fuzzy relation, Fuzzy equivalence relations, Fuzzy compatibility relations and Fuzzy ordering relations.
- CLO 2: understand about the belief and Plausibility measures, Probability measures, Possibility and Necessity measures.
- **CLO 3:** get the knowledge inMeasures of fuzziness, Classical measures of uncertainty, Measures of dissonance and Measures of confusion.
- **CLO 4:** learn theFuzzy controllers, Fuzzy systems and Neural Network and Fuzzy Automata with dynamic systems.
- **CLO 5:** increase their competencies in individual decision making, Multiperson decision making and Fuzzy ranking method.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	1	1	3	3	3	3	2	1
CLO2	1	2	2	3	3	3	3	2	1
CLO3	1	3	3	3	3	3	3	2	1
CLO4	3	1	1	3	3	3	3	2	1
CLO5	2	2	2	3	3	3	3	2	1

Title of the	Course	DISCRETE MATHEMATICS								
Paper Nun	nber									
Category	DSF-II C	Year	Ι	Credits	3	Cou	rse	23MMA1E6		
Category	DOLINC	Semester	Semester I			Code				
Instruction	nal Hours	Lecture	Tuto	orial	Lab Pract	tice	Tota	ıl		
per week		4	4 1 5							
Pre-requis	ite	UG level s	UG level sets and logic							
Objectives	of the	Aim of t	he pape	er is to o	levelop the	e kno	owled	ge in discrete		
Course		mathematic	es for le	ogic, recur	rence relati	on, la	attice	theory, coding		
		theory and	permuta	$\frac{1}{2}$	mbination.					
			Cours	e Outline						
		Logic – No	ormal for	rms – Princ	ipal normal	form	s – Th	eory of		
	NIT I	inference –	Open s	tatements –	Quantifiers	s - Va	lid fo	rmula and		
		equivalenc	e – Pred	icate Calcu	lus – More	than o	one qu	antifier.		
		(Chapter l	X: Sect	ions 11 to	18 of Text 1	Book	1)			
		Recurrence	e Relatio	ons and Ge	nerating Fu	nction	1s – R	lecurrence – an		
		introduction - Polynomials and their Evaluations Recurrence								
		Relations – Solution of Finite order Homogeneous (Linear)								
UN		Relations. Solution of Non-homogeneous Relations – Generations								
		Functions – Some Common Recurrence Relations – Primitive								
		(Chapter V: Sections 1 to 0 of Taxt Deals 1)								
		(Chapter	V: Secu	$\frac{0118 1 10 9 0}{50m0 D}$	on rext DOO	KI) Lotti	200	Now Lattians		
		Lattices – Lattices – Some Properties of Lattices – New Lattices – Modular and Distributive Lattices – Pooleon Algebra – Pooleon								
	іт ш	Algebras – Boolean Polynomials Karnaugh Man Switching								
		Circuits								
		(Chapter X: Sections 1 to 8 of Text Book 1)								
		Coding the	ory – In	troduction -	- Hamming	dista	nce –	e – Encoding		
		message –	Group c	odes – Proc	edure for g	enera	ting g	roup codes –		
UN	11 1V	Decoding e	error cor	rection.	C		00	1		
		(Chapter VIII: Sections 1 to 6 of Text Book 1)								
		The Basic	counting	g principle -	- The pigeor	nhole	princi	iple –		
		Permutatio	n and Co	ombination	– Binomial	coef	ficient	and Identities		
UN	IT V	– Generalis	sed Pern	nutation and	l Combinati	ions –	Gene	rating		
		Permutatio	n and Co	ombination	s.					
		(Chapter 6 : Sections 6.1 to 6.6 of Text Book 2)								
Extended	Professional	Questions	related	to the abo	ve tonics	from	vario	us competitive		
Component	t (is a part of	examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC								
internal	component	/ others to be solved								
only, Not t	o be included	(To be discussed during the Tutorial hour)								
in the	External			C		•				
Examinatio	n question									
paper)	-									

Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional								
course	Competency, Professional Communication and Transferrable Skill								
Recommended Text	1. Dr.M.K.Venkataraman, Dr.N.Sridharan and Dr.N.Chandra								
	Sekaran, <i>Discrete Mathematics</i> The National Publishing Company,								
	Chennai, 2001.								
	2. Kenneth H. Rosen, Discrete Mathematics and its Applications,								
	Fourth edition, McGraw Hill Publications.								
Reference Books	1.Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2 <sup>nd</sup> Indian								
	Reprint 2006, Springer Verlag, New York.								
	2. P Trembly and R. Manohar: Discrete Mathematical Structures								
	with Applications to Computer Science, Tata McGraw – Hill								
	Publishing Company Ltd, New Delhi 1997.								
	3.T. Veerarajan, Discrete Mathematics, Tata McGraw-Hill								
	Publishing company, 2007.								
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,								
e-Learning Source	http://www.opensource.org,								

Students will be able to

CLO 1: learn Logic, Theory of inference and Predicate Calculus.

**CLO2:** solve the recurrence relations, Generating Functions and Solution of Nonhomogeneous Relations.

CLO 3: teach the Latticetheory, Boolean Algebras, Karnaugh Map and Switching Circuits.

**CLO 4:**write a Coding and decoding theory that is useful to write a coding in computer.

CLO 5:solve the problems in Permutation and Combination problem.

			PO	PSOs					
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	3	3	3	2	1
CLO2	3	2	3	3	3	3	3	2	1
CLO3	3	2	3	2	3	3	3	2	1
CLO4	3	2	3	2	3	3	3	2	1
CLO5	3	2	3	1	3	3	3	2	1

Title of	' the			OFFICE A	ΠΤΟΜΑΤ	ION					
Course	the			OFFICEA							
Paner Nun	iher										
Category	SEC-	Vear	I	Credits	2	Course	e 23MMA1SP				
Category	I	Semester	I	Cicuits		Code					
Instruction		Lecture		utorial	Lab Pra	ctice	Total				
Hours		-									
per week											
Pre-requis	ite	Basic knowledge in Computer									
Objectives	of the	The aim of this course is to develop the concepts of MS Windows Ms									
Course		Word, MS Excel	MS Po	wer Point a	and MS Aco	cess.					
UNIT-I		MS Windows:	Concep	ts – Featur	res – Wind	lows Str	ructure – Desktop –				
		Taskbar – Start M	Aenu-	My Compu	ter My Pict	tures – N	Ay music – Working				
		with Recycle Bi	n – M	anaging fil	es and fol	ders: ex	ploring hard disk –				
		creating new fold	ler, sea	rching files	and folders	s – disk -	-navigating between				
		folders – coping	and me	oving files	and folder	from on	ne drive to another –				
		Windows Acces	sories -	- calculato	r – Notep	ad – Pa	aint – Word pad –				
		Character Map: Windows Explorer: exploring hard disk, coping and									
		moving files and folder from one drive to another Entertainment,									
		Installation of Hardware and Software, Using scanner, system tools,									
		communication,	sharing	informatior	n between c	omputer	S.				
		MS Word: Intro	oduction	n to MS Of	fice – Feat	ures & a	rea of use – Starting				
		Word - Parts of Word Window - Mouse operations - Keyboard operations									
		– Menus & Co	mmand	s – Toolba	rs and thei	r icons -	– Shortcut Menus –				
		Wizards and Te	mplates	s – Creatin	g a New	Documer	nt – Different Page				
		Views and layout	ts – Apj	olying vario	ous Text En	hanceme	ents; Working with –				
UNIT-II		Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using									
		various features; Bullets, Numbering, Autoformatting, Printing & various									
		print options Advanced Features: Spell Check, Thesaurus, Find &									
		Replace; Headers & Footers; Inserting- Page Numbers, Pictures, Files,									
		Autotexts, Symbols etc.; Working with Columns, Tabs & Indents; Creation									
		& Working with Tables including conversion to and from text; Margins &									
		Space manageme	nt In De	ocument; M	af use	Concort	ts of Workbook				
		Workshoots: Lisi		on – area orde: Voriou	of use –		ing different features				
		with Data Cell	ig wize	uus, variou ets: Salactir	is Data Typ	Selecting	r cells with mouse				
		Entering and Edi	iting ter	vt Enterir	ng cuits – L	formul	las and dates Text				
		alignment _ Ins	erting	Removing	$\frac{1}{2}$ Resiz	ing of	Columns & Rows				
UNIT – III		Working with D	ata &	Ranges Di	fferent Vie	ws of V	Worksheets Column				
		Freezing Labels	Hidin	o Snlittino	etc · Use	of Form	ulas Calculations &				
		Functions: Cell	Formatt	ing includ	ing Border	s & Sha	ading: Working with				
		Different Chart	Types:	Printing of	Workhook	& Worl	ksheets with various				
		options.	· JP • 0, 1		,, or of the other	~					
		options.									

# SKILL ENHANCEMENT COUIRSE:(Internal Paper)

	MS PowerPoint: Introduction & area of use – Creating a New								
	Presentation; Opening – Saving – Closing – Working with Presentation								
	Using Wizards; Slides & its different views: Creating, Inserting, Deleting								
UNIT-IV	and Copying of Slides; Menus: File - Edit - View - Insert - Format -								
	Tools – Slide Show – Window – Help – Working with Notes, Handouts,								
	Columns & Lists; Adding Graphics, Sounds and Movies to a Slide; Printing								
	Presentations, Notes, Handouts with print options.								
	MS Access: Introduction – Parts of an Access Window – Starting MS								
UNIT-V	Access – Database Creation – Table Creation using Table Wizard – Table								
	Creation using Design view – Saving Database – Query – Form – Reports								
Skills acquired	nowledge, Problem Solving, Analytical ability, Professional								
from this course	Competency, Professional Communication and Transferrable Skill								
<b>Reference Books</b>									
1. Windows XP	plete Reference. BPB Publications								
2. MS Office X	P complete BPB publication								
3. MS Office 20	000 by Sanjay Saxena, Vikas publishing house pvt Ltd.								
4. MS Windows	s XP Home edition complete, BPB Publications								
5. I.T. Tools and	d Applications, A. Mansoor, Pragya Publications								
Website and	https://wiki.openoffice.org/w/images/7/7e/Installation_Guide_OOo3.p								
e-Learning Source	<u>df</u>								
	https://wiki.openoffice.org/w/images/b/b1/AOO41GS.pdf								
Course Learning	g Outcome (for Mapping with POs and PSOs)								
Students will be a	ble to								
CLO 1: get knowled	MS Windows.								
CLO 2: write any le	tter using MS - Word.								

**CLO 3:** learn the concepts of MS-Excel. **CLO 4:** give an idea in MS-Power point.

CLO 5: learn the concepts of MS-Access.

	POs							PSOs		
	1	2	3	4	5	6	1	2	3	
CLO1	1	3	2	3	3	3	3	2	1	
CLO2	2	1	3	3	3	3	3	2	1	
CLO3	2	3	1	3	3	3	3	2	1	
CLO4	2	1	3	3	3	3	3	2	1	
CLO5	1	2	3	3	3	3	3	2	1	

**Note: Internal Examination only** 

Title of the	Course	MATHEMA	ATICS	FOR CON	MPETITIV	E EX	AMI	NATION - I			
Category	AECC-I	Year	Ι	Credits	2	Cour	·se	23MMA1AP			
		Semester	Ι			Code					
Instruction	al Hours	Lecture	T	utorial	Lab Practice			Total			
per week		-			2			2			
Pre-requisi	te	Basic Mathe	matics								
Objectives	of the	To update th	e skills	s in numeric	al and quar	ntitative	e tech	niques. Able to			
Course		critically eval	uate va	arious real li	fe situations	s by re	sortin	ig to Analysis of			
		key issues and	d factor	s. Able to d	emonstrate	various	princ	viples involved in			
		solving mathe	ematica	l problems	and thereby	reduci	ng th	e time taken for			
		performing jo	b funct	1011S	Desta	C1	. D				
UNII-I		Numbers – HCF – LCM – Square Roots & Cube Roots- Problems									
		Desimal Exactions, Simulification, Time & Distance									
UN11-11:		Decimal Fractions, Simplification, Time & Distance.									
		(Unapter 3,4,10) Sunda and Indiana Demonstrate Draft and Long Simula Interest									
UN11-111:		Suras and indices – Percentage – Profit and Loss- Simple Interest-									
		Compund Interest. (Chapters 9, 11, 22, 23)									
UNII-IV:		Ratio and Proportion – Partnership – Alligation or Mixture-									
LINUT V.		Probability. (Chapters 13, 14, 21, 31)									
	1.0 (1.)	Average – Problems on Age- Calendar. (Chapters 6,8,27)									
Skills acqui	red from this	Knowledge, Problem Solving, Analytical ability, Professional									
course		Competency, Professional Communication and Transferrable Skill									
Recommen	ded Text	Dr.R.S.Agga	irwal, '	'Quantitativ	e Aptitude	for Co	ompe	titive			
		Examination	s", S.	Chand& Co	mpany Ltd	, New	Delh	1-2007			
<b>Reference</b>	Books	1.Arun Shari	ma, Qu	antitative A	<i>1ptitude</i> , M	c-Grav	whill	publications.			
		2. Rajesh Varma, Fast Track Objective Arithmetic, Arihant									
		publications.									
Website an	d	https://books.shunyafoundation.com/book-quantitative-aptitude-by-									
e-Learning	Source	r-s-aggarwal	-publis	shedby-s-ch	and-english	n/dp/O	DTR	<u>GH2</u>			

Students will be able to

CLO 1: solve theproblems of Numbers, HCF, LCM, Square Roots & Cube Roots.

CLO 2: evaluate the problems of decimal Fractions, Simplification, Time & Distance.

**CLO 3:** find the solution of Surds and Indices, Percentage, Profit and Loss, Simple Interest and Compound Interest.

**CLO 4:** solve the problems of ratio and Proportion, partnership and Alligation or Mixture. **CLO 5:** analyse theconcepts of average, Problems on Age and Calendar.

			0,		0				
			P	PSOs					
	1	2	3	1	2	3			
CLO1	3	1	2	3	3	3	3	2	1
CLO2	2	1	3	2	3	3	3	2	1
CLO3	2	3	1	3	3	3	3	2	1
CLO4	1	3	2	3	3	3	3	2	1
CLO5	3	2	3	1	3	3	3	2	1

Note: Internal Examination only

	SEMESTER - II								
Title of the	e Course			ADVANC	ED ALGE	EBRA			
Paper Nur	nber								
Category	Core	Year	Ι	Credits	4	Cours	se 2	3MMA2C1	
		Semester	II			Code			
Instruction	nal Hours	Lectur	e T	utorial	Lab Pra	ctice		Total	
per week		4		1				5	
Pre-requis	site	Algebraic	Structures						
Objectives	of the	To study	field exten	sion, roots	of polynomial	mials, (	Galois	Theory, finite	
Course		fields, di	vision rin	gs, solvab	ility by	radical	s and	to develop	
		computatio	onal skill in	abstract alg	ebra.				
UNIT-I:		Extension	fields – Tra	inscendence	of e.				
		Chapter 5	: Section 5	.1 and 5.2					
UNIT-II : Roots or Polynomials More about roots									
		Chapter 5: Sections 5.3 and 5.5							
UNIT-III :		Elements of Galois theory.							
		Chapter 5 : Section 5.6							
UNIT-IV :	:	Finite field	s - Wedde	rburn's theo	rem on fini	ite divis	ion rin	gs.	
		Chapter 7	: Sections	7.1 and 7.	2 (Theorem	m 7.2.1	only)		
UNIT-V:		Solvability	by radical	s - A theore	em of Frob	enius -	Integra	al Quaternions	
		and the Fo	ur - Square	theorem.					
		Chapter :	5: Section	5.7 (omit	t Lemma	5.7.1,	Lemn	na 5.7.2 and	
		Theorem :	5.7.1)						
		Chapter 7	: Sections	7.3 and 7.4	1				
Extended		Questions	related to	the abov	ve topics,	from	variou	s competitive	
Professiona	al	examination	ons UPSC /	/ TRB / NE	T / UGC ·	– CSIR	/ GA	ΓΕ / TNPSC /	
Componen	t (is a part	others to b	e solved						
of internal		(To be disc	cussed durin	ng the Tutor	ial hour)				
component	only, Not								
to be includ	ded in the								
External									
Examinatio	on								
question pa	aper)								
Skills acqu	uired from	Knowledg	e, Proble	m Solvin	g, Analyt	tical a	ability,	Professional	
this course		Competen	ey, Professi	onal Comm	unication a	ind Tran	nsferral	ble Skill	
Recommen	nded	I.N. Hers	tein. Topic	es in Algeb	ra (II Edit	tion) W	viley E	asternLimited,	
Text		New De	lhi, 1975.						

<b>Reference Books</b>	1. M.Artin, Algebra, Prentice Hall of India, 1991.								
	2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, <i>Basic Abstract Algebra</i>								
	(II Edition) Cambridge University Press, 1997. (Indian Edition)								
	3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II								
	Rings, Narosa Publishing House, New Delhi, 1999								
	D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract								
	Algebra, McGraw Hill (International Edition), New York. 1997.								
	5. N.Jacobson, Basic Algebra, Vol. I & II Hindustan Publishing								
	Company, New Delhi.								
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,								
e-Learning Source	http://www.opensource.org, www.algebra.com								

Students will be able to

**CLO1:** Prove theorems applying algebraic ways of thinking.

CLO2: Connect groups with graphs and understanding about Hamiltonian graphs.

CLO3: Compose clear and accurate proofs using the concepts of Galois Theory.

CLO4: Bring out insight into Abstract Algebra with focus on axiomatic theories.

**CLO5:** Demonstrate knowledge and understanding of fundamental concepts including extension fields, Algebraic extensions, Finite fields, Class equations and Sylow's theorem.

			P	Os				PSOs           1         2           3         2           3         2           3         2           3         2           3         2           3         2           3         2	
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Cours	e	REAL ANALYSIS II								
Paper Number										
Category Core	Year	Ι	Credits	4	Cours	se 23MMA2C2				
	Semester	II			Code					
Instructional Hou	rs Lecture	e T	<b>`utorial</b>	Lab Prac	ctice	Total				
per week	4		1			5				
Pre-requisite	Elements o	f Real Ana	lysis							
Objectives of t	he To introdu	uce measu	re on the 1	real line, I	Lebesgu	e measurability and				
Course	integrabilit	y, Fourie	er Series	and Integ	grals,	in-depth study in				
	multivarial	ole calculus	5.							
UNIT-I:	Measure o	n the Rea	l line - Leb	esgue Outer	r Meası	ure - Measurable sets				
	- Regularit	y - Measur	able Function	ons - Borel a	and Let	besgue Measurability				
	Chapter -	2 Sec 2.1 t	o 2.5 (de Ba	arra)						
UNIT-II :		n of Func	tions of a	Real vari	able -	Integration of Non-				
	negative fi	unctions -	The Gener	al Integral	- R1e	mann and Lebesgue				
	Integrals									
	Chapter -	<u>3 Sec 3.1,3</u>	<u>5.2 and 3.4 (</u>	de Barra)	τ. 1	··· 0.1 1				
UNII-111:	system of t	system of functions. The theorem on best approximation. The Fourier								
	series of a	system of a function relative to an orthonormal system - Properties of								
	Fourier Co	Fourier Coefficients - The Riesz-Fischer Thorem - The convergence and								
	representat	representation problems in for trigonometric series - The Riemann -								
	Lebesque I	emma - T	he Dirichle	et Integrals	- An ir	tegral representation				
	for the par	tial sums o	f Fourier se	ries - Riem	ann's lo	ocalization theorem -				
	Sufficient	conditions	for converg	ence of a l	Fourier	series at a particular				
	point –Ces	arosumma	bility of Fo	ourier serie	s- Con	sequences of Fejes's				
	theorem - 7	The Weiers	trass approx	imation the	eorem	1 5				
	Chapter 1	1 : Section	s 11.1 to 11	.15 (Apost	ol)					
UNIT-IV :	Multivaria	ble Differ	ential Cal	culus - Intr	roductio	on - The Directional				
	derivative -	- Direction	al derivative	e and contin	nuity - '	The total derivative -				
	The total	The total derivative expressed in terms of partial derivatives - The								
	matrix of li	matrix of linear function - The Jacobian matrix - The chain rule - Matrix								
	form of c	hain rule	- The mean	n - value	theoren	n for differentiable				
	functions ·	- A suffic	ient conditi	on for diff	ferentia	bility - A sufficient				
	condition f	or equality	of mixed p	artial derivation	atives -	Taylor's theorem for				
	functions o	$f R^n$ to $R^1$								
	Chapter 1	2: Section	12.1 to 12.	14 (Aposto	<u>I)</u>					
UNIT-V:	Implicit F	unctions a	nd Extrem	um Problei	ms :Fur	nctions with non-zero				
	Jacobian c		ts - The 11	nverse tun	ction the	heorem-The Implicit				
	Tunction t	neorem-Ex	trema of	real value	a fund	ctions of severable				
	variables-E	xtremum p	$\frac{1214}{12}$	$\pi$ side cond	uitions.					
	Chapter 1	5 : Section	s 13.1 to 13	.7 (Aposto	I)					

Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC / TRB / NET / UGC - CSIR / GATE / TNPSC /
Component (is a part	others to be solved
of internal	(To be discussed during the Tutorial hour)
component only, Not	
to be included in the	
External	
Examination	
question paper)	
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
this course	Competency, Professional Communication and Transferrable Skill
Recommended	1. G. de Barra, Measure Theory and Integration, Wiley Eastern Ltd.,
Text	New Delhi, 1981. (for Units I and II)
	2. Tom M.Apostol : Mathematical Analysis, 2 <sup>nd</sup> Edition, Addison-
	Wesley Publishing Company Inc. New York, 1974. (for Units III, IV
	and V)
<b>Reference Books</b>	1. Burkill, J.C. <i>The Lebesgue Integral</i> , Cambridge University Press, 1051
	<ol> <li>Munroe M E Maggura and Integration Addison Wesley Mass 1071</li> </ol>
	2. Inditioc, M.E.Medsure and Integration. Addison-wessey, Mass. 1971.
	1988.
	4. Rudin, W. Principles of Mathematical Analysis, McGraw Hill
	Company, New York, 1979.
	5. Malik, S.C. and Savita Arora. Mathematical Analysis, Wiley Eastern
	Limited. New Delhi, 1991.
	6. Sanjay Arora and Bansi Lal, Introduction to Real Analysis, Satya
	Prakashan, New Delhi, 1991
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org

Students will be able to

**CLO1:** Understand and describe the basic concepts of Fourier series and Fourier integrals with respect to orthogonal system.

CLO2: Analyze the representation and convergence problems of Fourier series.

CLO3: Analyze and evaluate the difference between transforms of various functions.

**CLO4:** Formulate and evaluate complex contour integrals directly and by the fundamental theorem.

**CLO5:** Apply the Cauchy integral theorem in its various versions to compute contour integration.

		POs						PSOs		
	1	2	3	4	5	6	1	2	3	
CLO1	3	1	3	2	3	3	3	2	1	
CLO2	2	1	3	1	3	3	3	2	1	
CLO3	3	2	3	1	3	3	3	2	1	
CLO4	1	2	3	2	3	3	3	2	1	
CLO5	3	1	2	3	3	3	3	2	1	

Title of the	e Course		PARTIAL DIFFERENTIAL EQUATIONS								
Category	Core	Year	Ι	Credits	4	Cou	rse	23MMA2C3			
		Semester	II			Cod	e				
Instruction	nal Hours	Lectur	e	Tutorial	Lab Prac	ctice	Total				
per week		4 1 5									
Pre-requis	ite	UG level partial differential equations									
Objectives	of the	To classify the second order partial differential equations and to study									
Course		Cauchy pr	oblem,	method of se	paration of	varia	ıbles,	boundary value			
		problems.						_			
UNIT-I:		Mathemat	ical M	odels and Cla	ssification	of se	cond	order equation			
		:Classical	equation	ns-Vibrating st	ring – Vibr	ating	meml	orane – waves in			
		elastic med	lium – C	Conduction of h	leat in solid	ls – Gi	ravita	tional potential –			
		Second or	ler equa	ations in two in	dependent	variat	oles –	canonical forms			
		– equations	s with c	onstant coeffici	ents – gene	eral sol	lution	1			
		Chapter 2	: Section	ons 2.1 to 2.6							
		Chapter 3	: Section	ons 3.1 to 3.4 (	<u>Omit 3.5)</u>		~	1 77 1 1			
UNIT-II:		<b>Cauchy Problem :</b> The Cauchy problem – Cauchy-Kowalewsky									
		theorem – Homogeneous wave equation – Initial Boundary value									
		problem- Non-homogeneous boundary conditions – Finite string with									
		tixed ends – Non-homogeneous wave equation – Riemann method –									
		Goursat problem – spherical wave equation – cylindrical wave equation.									
LINUT III		Chapter 4	: Section	ons 4.1 to 4.11	lan Canan	ation	-f	wighte Witnesting			
		<b>Niethod of separation of variables:</b> Separation of variable- Vibrating									
		string problem – Existence and uniqueness of solution of vibrating string									
		solution of heat conduction problem I enlage and hear equations									
		Chapter 6 · Sections 6.1 to 6.6 (Omit section 6.7)									
UNIT-IV		Roundary Value Problems · Roundary value problems Maximum									
		and minimum principles – Uniqueness and continuity theorem –									
		Dirichlet Problem for a circle, a circular annulus a rectangle – Dirichlet									
		problem in	volving	Poisson equati	on – Neum	ann pi	roblei	n for a circle and			
		a rectangle	. 0	1		1					
		Chapter 8	: Section	ons 8.1 to 8.9							
UNIT-V:		Green's F	unction	: The Delta fu	nction – G	reen's	func	tion – Method of			
		Green's function – Dirichlet Problem for the Laplace and Helmholtz									
		operators – Method of images and eigen functions – Higher dimensional									
		problem –	Neumai	nn Problem.							
		Chapter 1	0 : Sect	<u>ion 10.1 to</u> 10.	9						

Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC / TRB / NET / UGC - CSIR / GATE / TNPSC /
Component (is a part	others to be solved
of internal	(To be discussed during the Tutorial hour)
component only, Not	
to be included in the	
External	
Examination	
question paper)	
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
this course	Competency, Professional Communication and Transferrable Skill
Recommended	TynMyint-U and Lokenath Debnath, Partial Differential Equations for
Text	Scientists and Engineers (Third Edition), North Hollan, New York,
	1987.
<b>Reference Books</b>	1. M.M.Smirnov, Second Order partial Differential Equations,
	Leningrad, 1964.
	2. I.N.Sneddon, <i>Elements of Partial Differential Equations</i> , McGraw
	Hill, New Delhi, 1983.
	3. R. Dennemeyer, Introduction to Partial Differential Equations and
	Boundary Value Problems, McGraw Hill, New York, 1968.
	4. M.D.Raisinghania, Advanced Differential Equations, S.Chand&
	Company Ltd., New Delhi, 2001.
	5. S, Sankar Rao, <i>Partial Differential Equations</i> , 2 <sup>nd</sup> Edition, Prentice
	Hall of India, New Delhi. 2004
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, www.mathpages.com

Students will be able to

CLO1: To understand and classify second order equations and find general solutions

**CLO2:** To analyse and solve wave equations in different polar coordinates

**CLO3:** To solve Vibrating string problem, Heat conduction problem, to identify and solve Laplace and beam equations

**CLO4:** To apply maximum and minimum principle's and solve Dirichlet, Neumann problems for various boundary conditions

**CLO5:** To apply Green's function and solve Dirichlet, Laplace problems, to apply Helmholtz operation and to solve Higher dimensional problem

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the	Course	ALGEBRAIC GEOMETRY									
Category	DSE-III A	Year	Ι	Credits	3	Cou	rse	23MMA2E1			
		Semester	II	]		Cod	e				
Instruction	al Hours	Lecture	Т	utorial	Lab Prac	ctice		Total			
per week		4		1				5			
Pre-requisi	te	UG level A	lgebra	concepts							
Objectives	of the	The aim of	this cou	urse is to de	velop basic	algeb	raic to	ools to explore			
Course		the geometr	y of the	ese varieties	. We will b	uild u	p a di	ctionary between			
		geometric p	roperti	es of varieti	es and num	erical	invar	iants of			
		equations.									
UNIT-I		Commutativ	Commutative Algebra Nakayama lemma – Hilbert basis theorem –								
		localization	- Noet	therian grad	ed rings – H	Euler a	and Ta	aylor identities –			
		homogeneo	us loca	lization – K	rull and Ch	evally	v dime	ensions – Hilbert-			
		Samuel poly	/nomia	l – dimensio	on theorem	– Kru	ll's pi	rincipal ideal			
		theorem – d	imensi	on of polyne	omial rings	•					
		Chapter 1.	Section	ns 10 to 14							
UNIT-II		Commutativ	ve Alge	ebra (Contd.	) Genera	lities -	– goir	ig up theorem –			
		Noether's n	ormaliz	zation lemm	a – Hilbert	's Nul	lstelle	ensatz – regular			
		ring and UF	Ds - ci	riteria for no	ormality – r	elative	e norr	nalizations –			
		towards Zariski's main theorem – Schmidt and Lüroth's theorems –									
		elimination theory.									
		Chapter 1: Sections 15 to 18									
UNIT-III		Alline varieties - Alline algebraic sets – regular functions –									
		irreducible algebraic sets – affine varieties – complete intersections –									
		tinite sets and curves – surfaces and solids.									
		Chapter 2: Sections 21 to 26.2									
UNIT-IV		Attine Varieties (Contd) Linear varieties – determinantal varieties –									
		group varieties – morphisms – rational morphisms – birational									
		equivalence – products.									
LINIT V		Projective V	Joriotio	ns 20.5 to 2	0	ntivo A	lach	raic sets			
0111-1		homogenisa	tion / d	lehomogeni	sation _ project	viectiv	e clos				
		mornhisms products complete verifica									
		Chapter 3: Sections 31 to 37									
			Sectio								
Extended	Professional	Ouestions 1	elated	to the ab	ove topics.	fron	ı var	ious competitive			
Component	(is a part of	examination	s UPS	C / TRB / N	NET / UGC	z - CS	IR / C	GATE / TNPSC /			
internal	component	others to be	solved								
only, Not to	be included	(To be discu	issed d	uring the Tu	torial hour	)					
in the	External			C							
Examination	n question										
paper)	-										
Skills acqui	red from this	Knowledge	, Pro	blem Solv	ing, Analy	ytical	abili	ity, Professional			
course		Competency	y, Profe	essional Cor	nmunicatio	n and	Trans	sferrable Skill			

<b>Recommended Text</b>	Musli, "Algebraic Geometry for Beginners", Text and Readings in									
	Mathematics Vol.20, Hindustan Book Agency (India), New Delhi,									
	2001.									
<b>Reference Books</b>	1. N. Bourbaki, "Commutative Algebra", Chapters 1-7, Springer,									
	1985.									
	2. D. Bump, "Algebraic Geometry", World Scientific, Singapore,									
	1998.									
	3. D. Eisenbud, "Commutative Algebra with a view towards Algebraic									
	Geometry", GTM Vol. 150, Springer, 1995.									
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,									
e-Learning Source	http://www.opensource.org, www.mathpages.com									

Students will be able to

CLO 1: learn Commutative Algebraic structures and some familiar theorems.

**CLO 2:** learn about the normalization, relative normalizations, Zariski's main theorem, Schmidt and Lüroth's theorems.

**CLO 3:** defineaAffine algebraic sets, regular functions, affine varieties, curves and surfaces.

CLO 4:Know the different types of varieties and morphisms.

CLO 5 :Understand the Projective Varieties Terminology, projective closures and products.

		POs         PSOs           2         3         4         5         6         1         2           2         1         3         3         3         3         2           3         3         2         3         3         3         2           3         2         1         3         3         2         2           1         2         1         3         3         2         2							
	1	2	3	4	5	6	1	2	3
CLO1	3	2	1	3	3	3	3	2	1
CLO2	2	3	3	2	3	3	3	2	1
CLO3	1	3	2	1	3	3	3	2	1
CLO4	2	1	2	3	3	3	3	2	1
CLO5	3	2	3	2	3	3	3	2	1

Title of the Course		MATHEMATICAL STATISTICS								
Paper Number										
Category	DSE-III B	Year	Ι	Credits	3	Course	23MMA2E2			
		Semester	II			Code				
Instructional Hours		Lecture	T	utorial	Lab Prac	tice	Total			
per week		4	1				5			
Pre-requisite		UG level F	UG level Probability & statistics							
Objectives	of the	The main objectives of this course are to: Enables to learn different								
Course		aspects of statistics. Acquire knowledge about moments and								
		properties of theoretical distributions. Study unbiasedness and								
		consistency of limiting distributions								
UNIT-I		Probability and Distributions - Introduction - Set Theory - The								
		Probability Set Function - Conditional Probability and Independence								
		-Random Variables - Discrete Random Variables- Continuous								
		Random Variables								
		Chapter 1:Sections 1.1 to 1.7								
UNIT-II		Probability and Distributions (continued) and Multivariate								
		Distributions Probability and Distributions: Expectation of a Random								
		variables - Some Special Expectations - Important Inequalities.								
		Wullivariate Distributions: Distributions of 1 Wo Kandom Variables -								
		Distributions and Expositions Independent Depidem Variables								
		Distributions and Expectations - independent Kandom variables. Chapter 1 & 2 · Sections 1.8 to 1.10, 2.1 to 2.3, 2.5								
		Some Special Distributions The Pinomial and Palatad Distributions								
UNIT-III		- The Poisson Distribution - The $\Gamma_{12}$ and $\beta$ Distributions - The								
		Normal Distribution								
		Chapter 3 : Sections 3.1 to 3.4								
UNIT-IV		Some Special Distributions (continued) Unbiasedness Consistency								
		and Limiting Distributions - Some Special Distributions (continued): t								
		and F-Distributions. Unbiasedness, Consistency and Limiting								
		Distributions: Expectations of Functions - Convergence in Probability								
		- Convergence in Distribution - Central Limit Theorem.								
		Chapter 3& 4: Sections 3.6, 4.1 to 4.4								
UNIT-V		Some Elementary Statistical Inferences- Sampling and Statistics –								
		More on Confidence Intervals - Introduction to Hypothesis Testing -								
		Additional Comments About Statistical Tests - Chi-Square Tests -								
		The Method of Monte Carlo.								
		Chapter 5: Sections 5.1, 5.4 to 5.8								
Extended Professional		Questions related to the above topics, from various competitive								
Component (is a part of		examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /								
internal component		others to be solved								
only, Not to be included		(To be discussed during the Tutorial hour)								
in the External										
Examination question										
paper)										
Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional									
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course	Competency, Professional Communication and Transferrable Skill									
<b>Recommended Text</b>	Robert V. Hogg, Allen T. Craig and Joseph W. McKean, Introduction									
	to Mathematical Statistics, Sixth Edition, Pearson Education, 2005.									
<b>Reference Books</b>	1. K. L. Chung, A course in Probability, Academic Press, New York,									
	1974.									
	2. R. Durrett, Probability: Theory and Examples, (2nd Edition)									
	Duxbury Press, New York, 1996.									
	3. Y. S. Chow and H. Teicher, Probability Theory, 2nd Edition,									
	Springer Verlag, Berlin, 1988									
Website and	https://nptel.ac.in/courses/111/104/111104032/									
e-Learning Source	https://nptel.ac.in/courses/111/105/111105090									
	https://nptel.ac.in/courses/111/101/111101004									

Students will be able to

**CLO 1:** Remembering the understanding the basic concepts such as statistics, probability and random variables.

CLO 2: Applying the concepts and methods to find the moments of the distributions.

**CLO 3:** Study multivariate distributions and the independence of random variables. Further evaluating the marginal distributions from bivariate distributions.

**CLO 4** :Analyze and study the properties of some discrete as well as continuous distributions **CLO 5** :Understand the convergence of distributions and central limit theorem.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	2	2	3	2	3	3	3	2	1
CLO2	1	3	3	2	3	3	3	2	1
CLO3	2	2	3	2	3	3	3	2	1
CLO4	1	3	3	3	3	3	3	2	1
CLO5	2	2	3	3	3	3	3	2	1

Title of the	Course		ΓENSO	R ANALY	SIS AND I	RELATIV	/ITY		
Paper Number									
Category	DSE-III	Year	Ι	Credits	3	Course	23MMA2E3		
	C	Semester	II			Code			
Instructional H	ours	Lecture	Т	'utorial	Lab Prac	tice	Total		
per week		4	4 1 5						
Pre-requisite		UG level Analysis and Mechanics							
Objectives of th	e Course	The aim of this course is to develop basic invariance tools to explore the							
		tensors of varieties. We will build up a special theory and relativity.							
UNIT-I		Invariance - T	ransforr	nations of c	oordinates a	and its pro	perties -		
		Transformatio	n by inv	variance - Tr	ansformati	on by cov	ariance and contra		
		variance - Cov	variance	and contra	variance - 7	ensor and	l Tensor character		
		of their laws -	Algebra	as of tensors	- Quotient	tensors -	Symmetric and		
		skew symmetr	ric tenso	rs – Relativ	e tensors.				
		Chapter 2: Se	ections 1	18 to 28 of	Text Book	1			
UNIT-II :		Metric Tensor	- The fi	undamental	and associa	ited tensor	rs - Christoffel's		
		symbols - Tran	nsforma	tions of Chr	isffel's sym	bols- Cov	ariant		
		Differentiation	n of Ten	sors - Form	ulas for cov	ariant Dif	ferentiation-Ricci		
		Theorem - Rie	mann -0	Christoffel 7	Tensor and	their prop	erties.		
		Chapter 2: Sections 29 to 37 of Text Book 1							
UNIT-III		Einstein Tenso	or- Rien	nannian and	Euclidean	Spaces (E	xistence Theorem)		
		- The esystems and the generalized Kronecker deltas - Application of the							
		e-systems.							
		Chapter 2: Se	ection 3	<u>8 to 41 of T</u>	ext Book 1				
UNIT-IV :		Special Theor	y of Rel	ativity: Gali	lean Transf	ormation	- Maxwell's		
		equations - The ether Theory – The Principle of Relativity Relativistic							
		Kinamatics : I	orentz '	Fransformat	ion equatio	ns - Even	ts and simultaneity		
		- Example Einstein Train - Time dilation - Longitudinal Contraction -							
		Invariant Interval - Proper time and Proper distance – World line -							
		Example - twin paradox - addition of velocities - Relativistic Doppler							
		effect.							
		Chapter 7: Se	ections (	7.1 and 7.2	of Text Bo	ok 2			
UNIT-V:		Relativistic D	ynamics	: Momentu	m – energy	– Momer	tum-energy four		
		vector – Force	-Cons	ervation of	Energy – M	lass and e	nergy – Example –		
		inelastic collis	10n - Pr	inciple of e	uvalence	– Lagrang	ian and		
		Hamiltonian fo	ormulati	ions. Accele	rated Syste	ms: Rock	et with constant		
		acceleration –	exampl	e – Rocket v	vith constai	nt thrust.			
		Chapter 7: Se	ections	/.3 and 7.4	of Text Bo	ok 2			
Exter de d	mafazzi	Ouestiers	ata 1 4	41a 1.		from -			
Extended P	roiessional	Questions rel		) the abov	T $/$ UCC	Irom va	rious competitive		
internal acres	a part or	examinations	UPSC /	1 KD / INE	1/000-	- USIK /	UALE / INPSC /		
Not to be included	inded in the	(To be diagram	ad dumin	a tha Tutan	al hour				
External E	vomination	(10 be discuss	eu aurir	ig me i utor	iai nour)				
External E	xamination								
question paper)									

Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional									
course	Competency, Professional Communication and Transferrable Skill									
<b>Recommended Text</b>	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.									
<b>Reference Books</b>	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.									
Website and	https://www.f.waseda.jp/sidoli/Einstein Relativity.pdf									
e-Learning Source	https://web.math.princeton.edu/~nelson/books/ta.pdf									

Students will be able to

CLO 1: Understand tensor algebra and its applications in applied sciences and engineering.

CLO 2: Know the fundamental mathematics of tensor that are important for higher learning

**CLO 3:** Work with some tools in branches of applied mathematics, physics and geophysics

**CLO 4**: Demonstrate knowledge and broad understanding of Special Relativity. Explain the meaning and significance of the postulate of Special Relativity.

**CLO 5:** Explain true nature of Lorentz transformation and Doppler Effect. Explain relativistic momentum and Einstein field equations.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	2	2	3	2	3	3	3	2	1
CLO2	2	3	3	3	3	3	3	2	1
CLO3	1	3	3	2	3	3	3	2	1
CLO4	2	2	3	2	3	3	3	2	1
CLO5	1	3	3	3	3	3	3	2	1

Title of the	Course	CALCULU	JS OF	VARIATIO	DNS AND	INTEC	GRA	L EQUATIONS		
Paper Nun	ıber									
Category	DSE-IV A	Year	Ι	Credits	3	Cour	se	23MMA2E4		
		Semester	II	1		Code				
Instruction	al Hours	Lecture	Γ	utorial	Lab Prac	tice		Total		
per week		4		5						
Pre-requisi	ite	UG level c	alculus							
Objectives	of the	The aim of	The aim of this course is to obtain thorough analysis of various							
Course		aspects of c	spects of calculus of variations. To acquire the knowledge of solving							
		problems in	the fie	elds of mech	anics and n	nathem	atica	al physics.		
UNIT-I		(CALCUL	US OI	F VARIATI	ONS)					
		The method	of var	iations in pr	oblems wit	h fixed	bou	ndaries.		
		(hapter 6 o	f Text	Book 1						
UNIT-II:		Vibrational	proble	ms with mo	ving bound	aries ar	nd ce	ertain other		
		problems –	Suffici	ent conditio	n for an ext	tremum	1.			
		Chapter 78	k8 of 1	<b>Text Book 1</b>						
UNIT-III		Variational	Proble	ms Involvin	g a Conditi	onal Ex	xtren	num - Direct		
		Methods in	Variati	ional Proble	ms.					
		(Chapter 9	&10 of	f Text Book	1)					
UNIT-IV :	(	INTEGRAL EQUATIONS)								
		Linear Integral Equations - Definition, Regularity conditions - special								
		kind of kernels - eigen values and eigen functions - convolution								
		Integral - th	e inner	and scalar p	product of t	wo fun	ction	ns - Notation -		
		reduction to	a syst	em of Algeb	raic equation	ons - ex	kamp	ples – Fredholm		
		alternative -	exam	ples - an app	roximate n	nethod.				
		Chapter 18	k2 of T	<b>Text Book 2</b>						
UNIT-V:		Method of s	uccess	ive approxi	nations: Ite	rative s	schei	me - examples -		
		Volterra Int	egral e	quation - ex	amples - so	me res	ults	about the		
		resolvent ke	ernel. C	lassical Fre	dholm Theo	ory: the	eme	thod of solution		
		of Fredholm	ı - Frec	lholm's first	theorem -	second	theo	orem - third		
		theorem.								
		Chapter 38	<u>k4 of T</u>	Fext Book 2						
Extended	Professional	Questions	related	to the ab	ove topics.	, from	var	ious competitive		
Component	is a part of	examination	is UPS	C / TRB / N	NET / UGC	c - CSI	R / (	GATE / TNPSC /		
internal	component	others to be	solved			、 、				
only, Not to	o be included	(To be discu	issed d	uring the Tu	itorial hour	)				
in the	External									
Examinatio	n question									
paper)	· . 1 C		n	1.1 <u>C</u> _1			-1.'1	itaa Duaf i 1		
Skills acqui	ired from this	Knowledge	, Pro	blem Solv	ing, Analy	ytical	abili	ity, Professional		
Deserver	ded Te-4	Competency	y, Prote	essional Cor		n and	rans	sterradie SKIII		
Kecommen	iueu l'ext	I.L. Elsgolt	s, DIII(	erential equa	$\frac{1}{2002}$	ne calc	uius	or variations,		
		2 Rom D V	Tess 0	I une Pacific	5, 2003. 2003.	ions TI	h00m	y and Practica		
		2.Naill. F. N	anwal Doctor		grai Equal	10115 11	neor.	y and reactive,		
		Birkhauser	Boston	, 2012.						

Reference Books	1. S.G.Mikhlin, Linear Integral Equations, Hindustan Publishing
	Corp. Delhi,1960.
	2 L.A.Pars, An Introduction to the Calculus of Variations,
	Heinemann, London, 1965.
	3 R.Weinstock, Calculus of Variations with Applications to Physics
	and Engineering, McGraw-Hill Book Company Inc. New York, 1952.
Website and	https://www.researchgate.net/file.PostFileLoader.html?id=56c4564d5
e-Learning Source	<u>cd9e3c</u>
	https://www.researchgate.net/profile/AndreiPolyanin/publication/275
	<u>518932</u>

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

**CLO 1:** Understand the concepts of calculus of variation and its properties

**CLO 2:** Use Euler's equation to solve various types of variational problems with fixed boundaries.

**CLO 3:** Modify the Euler's formula for a class of curves with moving boundary points. Also Derive sufficient conditions based on second variation

**CLO 4** : solve he problems related with reflection and refraction, diffraction of light rays. Classify Fredholm, Volterra and singular type integral equations

**CLO 5**:solve integral equations using Fredholm theorem, Fredholm Alternative theorem and method of successive approximations. Understand the classical Fredholm theory

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	2	2	2	3	3	3	2	1
CLO2	3	2	3	2	3	3	3	2	1
CLO3	3	2	2	2	3	3	3	2	1
CLO4	3	2	3	2	3	3	3	2	1
CLO5	3	3	2	2	3	3	3	2	1

Title of the Cour	rse	WAVELETS									
Paper Number											
Category D	SE-IV	Year	Ι	Credits	3	Course	23MMA2E5				
B		Semester	II			Code					
Instructional Ho	ours	Lecture	Т	utorial	Lab Prac	tice	Total				
per week		4	4   1								
Pre-requisite		UG level T	UG level Transform Techniques								
Objectives of	f the	The aim of	The aim of this course is to develop the Fourier transform techniques								
Course		and Z trans	forms te	echniques.							
UNIT-I		The Discre	te Fou	rier Transf	orms:						
		Basic prope	erties of	the Discret	e Fourier T	ransform	– Translation –				
		invariant Li	inear Tr	ansformatio	ons.						
		Chapter 2	: Sectio	ons 2.1 to 2.	3						
UNIT-II :		Wavelets o	n Z <sub>N</sub> :			_					
		Constructio	n of W	avelets on Z	$\mathcal{L}_{N}$ : The first	t stage – C	Construction on				
		Wavelets of	$n Z_N : T$	he iteration	setp.						
		Chapter 3	: Sectio	ons 3.1 and	3.2						
UNIT-III		Wavelets o	n Z :				- 2				
		$\mathcal{L}(Z) - \operatorname{con}$	plete of	rthonormal	sets in Hilb	ert spaces	$\mathbf{s} - \mathbf{L}^{2} [ -\pi, \pi ]$ and				
		Fourier Ser	ies.								
		Chapter 4	: Sectio	ons 4.1 to 4.	3						
UNIT-IV :		Wavelets o	n Z ( C	continued):		<b>6</b> 2					
		The Fourier	r Transf	form and Co	onvolution of	on $\ell^2(\mathbf{Z})$ - ]	First-Stage				
		Wavelets of	n Z -Th	e Iteration S	Step for Wa	velets on .	Ζ.				
		Chapter 4	: Sectio	ons 4.4 to 4.	6						
UNIT-V:		Wavelets o	n R:								
		$L^{2}(R)$ and	Approx	imate Identi	ities -The F	ourier Tra	insform on R -				
		Multiresolu	tion Ar	alysis and V	Wavelets - (	Constructi	on of				
		Multiresolu	tion An	alyses -Wa	velets with	Compact	Support and Their				
		Computatio	on.		_						
		Chapter 5	: Sectio	ons 5.1 to 5.	5						
Extended Prof	essional	Questions	related	to the ab	ove topics,	from va	arious competitive				
Component (1s a	part of	examination	ns UPS	C / TRB / M	NET / UGC	= CSIR /	GATE / TNPSC /				
internal con	nponent	others to be	solved			\ \					
only, Not to be i		(10 be disc	ussea a	uring the It	itorial nour	)					
In the I											
Examination (	question										
Skills acquired for	rom this	Knowlada	Drol	lem Salu	ing Analy	rtical ab	ility Professional				
Course	om uns	Competence	v Profe	ore SUIV	mg, Analy	n and Tra	nsferrable Skill				
Recommended 7	[evt	Michael W	y, 11010 Fraier	An Introdu	tion to Wa	velets the	noteria ole okili				
	LVAL	Algebra Sr	ringer	verlag Rerl	$\frac{1001}{1000}$						
			ninger	, enu <sub>5</sub> , Dell	, 1777						

Reference Books	1. C.K. Chui, An Introduction to Wavelets, Academic Press, 1992
	2. E. Hernande and G.Weiss, A First Course in Wavelets, CRC Press, NY 1996.
	3. D.F. Walnut, Introduction to Wavelet Analysis, Birkhauser, 2004
Website and	https://inst.eecs.berkeley.edu/~ee225b/sp14/lectures/shorterm.pdf
e-Learning Source	http://math.bu.edu/people/mkon/Wavelets.pdf
	http://disp.ee.ntu.edu.tw/tutorial/WaveletTutorial.pdf

Students will be able to

CLO 1: know the Discrete Fourier Transforms.

**CLO 2:** solve the problems in Wavelets on  $Z_N$ .

CLO 3: solve the Wavelets on Z.

**CLO 4:**create a new one Wavelets on Z

CLO 5: solve and create the Wavelets on R.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	1	3	3	2	3	3	3	2	1
CLO2	2	3	3	3	3	3	3	2	1
CLO3	2	3	3	2	3	3	3	2	1
CLO4	2	3	3	2	3	3	3	2	1
CLO5	2	3	3	3	3	3	3	2	1

Title of the	Course	MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE								
Paper Nun	ıber									
Category	Elective	Year	Ι	Credits	3	Coui	rse	23MMA2E6		
		Semester	II			Code	e			
Instruction	al Hours	Lecture	T	utorial	Lab Practice To			Total		
per week		4 1 5								
Pre-requisi	ite	UG level M	[athem	atics						
Objectives	of the	The aim of	this co	ourse is to d	evelop abo	out Ma	chine	e Intelligence and		
Course		Machine Le	earning	g application	ns. To imp	olemer	nt an	d apply machine		
		learning al	lgorith	ms to re	al-world a	applica	plicationsand apply the			
		appropriate	mach	ine learning	g techniqu	e to	class	ification, pattern		
		recognition,	optim	ization and	decision pro	oblems	5.			
UNIT-I :		Introductio	n:Lea	rning Proble	ms – Persp	ective	s and	Issues – Concept		
		Learning –	Versic	on Spaces a	nd Candida	ate Eli	mina	tions – Inductive		
		bias – Dec	rision	Tree learn	ng – Rep	resent	ation	– Algorithm –		
		Heuristic Sp	ace Se	earch.	A <b>1</b> • / <b>1</b>					
UNIT-II:		Neural Net	works	and Geneti	c Algorith	ms:				
		Neural Net	work	Representa	tion – Pi	roblem	1S —	Perceptron's –		
		Multilayer I	Netwoi	rks and Bac	K Propagat	ion A	Igorit	nms – Advanced		
		Topics – Genetic Algorithms– Hypothesis Space Search – Genetic								
		Programming – wooders of Evaluation and Learning								
UN11-111:		Bayes Theorem – Concept Learning – Maximum Likelihood –								
		Bayes Incorem – Concept Learning – Maximum Likelihood –								
		Gibbs Algor	rithm	Naïve Bay	- Fincipie -	- Daye ər Ra	vecia	n Belief Network		
		Globs Algorithm – Nalve Bayes Classifier – Bayesian Beller Network								
		and Infinite	Hypot	hesis Snaces	s – Mistake	Round	d Mo	del		
UNIT_IV ·		Introduction	- Intel	ligent Ager	ts · Proble	m Sol	ving	- by Searching -		
		Informed Search Strategies-Ontimization Problems - Adversarial								
		Search-Knowledge and Reasoning - Logical Agents - First-Order								
		Logic - Infe	rence i	n First-Orde	er Logic - K	Lnowle	edge ]	Representation.		
UNIT-V:		Planning –	Plann	ing and A	cting in th	ne Rea	al W	orld - Uncertain		
		knowledge	and re	asoning - U	Incertainty	- Pro	babil	istic Reasoning -		
		Probabilistic	e Reas	soning over	Time - N	Making	g Sin	nple Decisions -		
		Making Con	nplex ]	Decisions.						
Extended	Professional	Questions r	elated	to the ab	ove topics,	, from	n var	ious competitive		
Component	i (is a part of	examination	s UPS	C / TRB / N	VET / UGC	C - CS	IR / (	GATE / TNPSC /		
internal	component	nt others to be solved								
only, Not to	o be included	d (To be discussed during the Tutorial hour)								
in the	External	mal								
Examinatio	n question									
paper)					-					
Skills acqui	ired from this	Knowledge	, Pro	blem Solv	ing, Analy	ytical	abili	ity, Professional		
course		Competency	v, Profe	essional Cor	nmunicatio	n and	Trans	sferrable Skill		

Recommended Text	1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
	2. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach," Third Edition, Prentice Hall of India, New Delhi, 2010.
D.f	1 Educe Alexadia Interdiante Martine Interior (Alexadian
Keierence Books	1. Etnem Alpaydin,—Introduction to Machine Learning (Adaptive
	2. Stanbar Mandaul – Mashing Learning, The Will Fless 2004.
	2. Stephen Marsiand,—Machine Learning: An Algorithmic
	Perspective, CRC Press, 2009.
	3. Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas
	Beham, —Genetic Algorithms and Genetic Programming, CRC Press
	Taylor and Francis Group.
	4. Elaine Rich, Kevin Knight, B. Nair, "Artificial Intelligence," Third
	Edition, Tata McGraw-Hill, New Delhi, 2017.
	5. Eugene Charniak, Drew McDermott, "Introduction to Artificial
	Intelligence," Pearson, 2002.
Website and	
e-Learning Source	https://inst.eecs.berkeley.edu/~ee225b/sp14/lectures/shorterm.pdf
8	http://math.bu.edu/people/mkon/Wavelets.pdf
	http://disp.ee.ntu.edu.tw/tutorial/WaveletTutorial.pdf
	<u> </u>

Students will be able to

**CLO 1:** have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc

**CLO 2:** appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and unsupervised learning.

**CLO 3:** Be able to design and implement various machine learning algorithms in a range of realworld applications.

CLO 4: understand the computation intelligence.

**CLO 5:** apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	1	3	3	2	3	3	3	2	1		
CLO2	2	3	3	3	3	3	3	2	1		
CLO3	2	3	3	2	3	3	3	2	1		
CLO4	2	3	3	2	3	3	3	2	1		
CLO5	2	3	3	3	3	3	3	2	1		

# **SKILL ENHANCEMENT COURSE : (Internal Paper)**

Title of the (	Course		Mathe	matical Do	cumentatio	on using	LATEX			
Paper Numb	ber									
Category	SEC-II	Year	Ι	Credits	2	Course	e 23MMA2SP			
		Semester	II	1		Code				
Instructiona	l Hours	Lecture	Γ	utorial	Lab Pra	Total				
per week		3	3 - 3							
Pre-requisite	e	UG level Mathematics								
Objectives	of the	The aim of this course is to make the students learn the art of typing								
Course		mathematic	mathematics text on their own. To inculcate professional training							
		required to	become	e a scholar i	n mathema	tics.				
UNIT- I		Introduction	1 - Text	t formatting	, TEX and	its offspı	ring, What's			
		different in	LATE	X 2 $\epsilon$ , Distin	guishing La	aTex 2¢,	Basics of a LaTex			
		file.								
UNIT-II :		Commands	and Er	vironments	- Comman	d names	and arguments,			
		Environme	nts, Dee	clarations, L	engths, Sp	ecial Cha	aracters – Spaces			
		and carriage	e return	s, Quotation	n marks, Hy	yphens a	nd dashes, Printing			
		command c	haracte	ers.						
UNIT-III		Document Layout and Organization, Displayed Text - Document								
		class, Page style, Parts of the document, Table of contents –								
		Automatic entries, Printing the table of contents, Fine-Tuning text –								
		Line breaking, Page breaking. Displayed Text – Changing font –								
		Emphasis, C	Choice	of font size	, Font attrib	outes, Ce	ntering and			
		indenting, I	lists.							
UNIT-IV :		Displayed 7	ſext (C	ontinued) -	Tables, Prin	nting lite	eral text, Footnotes			
		and margina	al notes	5.						
UNIT – V		Mathematical Formulae - Mathematical environments, Main elements								
		of math mo	de, Ma	thematical s	ymbols – C	Greek let	ters, function names,			
		Additional	elemen	ts, Fine–tun	ing mathen	natics – l	Horizontal spacing,			
		Selecting fo	ont size	in formulas	5.					
Skills acquire	ed from this	Knowledge	e, Pro	blem Solv	ing, Anal	ytical a	bility, Professional			
course		Competenc	y, Profe	essional Con	nmunicatio	on and Ti	ransferrable Skill			
Reference B	ooks	1. Leslie La	mport.	LATEX: A	Document	Prepara	tion System,			
		Addison-W	esley, l	Reading, Ma	assachusett	s, second	l edition, 1994.			
		2. Helmut k	Kopka a	and Patrick	W. Daly, A	Guide to	o LATEX, Third			
		Edition, Ad	dison –	- Wesley, Lo	ondon,1999	).	10			
Website and		http://mirro	rs.ctan.	org/info/lsh	ort/english	/lshort.po	<u>df</u>			
e-Learning S	Source	https://wwv	v.tug.or	<u>g/twg/mact</u>	<u>ex/tutorials</u>	/ltxprim	<u>er-1.0.pdf</u>			
		https://docs	.kde.or	<u>g/trunk4/en</u>	extragear_	office/ki	le/quick-using.html			
		https://wwv	v.ctan.c	org/tex-arch	ive/info/sin	plified-	latex/			

**Course Learning Outcome (for Mapping with POs and PSOs)** On the successful completion of the course, student will be able to: **CLO 1:** Understand basic concepts of Text formatting and LaTex file

**CLO 2:** Demonstrating command names and arguments, Special characters.

CLO 3: Apply the commands to create document layout and displayed output

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	1	2	3	2	3	3	3	2	1		
CLO2	2	2	3	2	3	3	3	2	1		
CLO3	2	2	3	3	3	3	3	2	1		
CLO4	1	3	3	3	3	3	3	2	1		
CLO5	1	2	3	2	3	3	3	2	1		

CLO 4: Create	able, Printing Text, Foot notes and marginal not	es
CLO 5 : Apply	LaTex commands to mathematical formulae	

Note: Internal Examination only

#### ABILITY ENHANCEMENT COURSE: (Internal Paper)

Title of the Co	urse	MATHEMATICS FOR COMPETITIVE EXAMINATION - II							
Paper Number	ſ								
Category A	AECC-II	Year	Ι	Credits	2	Cours	se	23MMA2AP	
		Semester	II			Code			
Instructional H	Iours	Lecture	T	'utorial	Lab Pract		e Total		
per week		2		-				2	
Pre-requisite		Basic Mathematics							
Objectives	of the	To update the skills in numerical and quantitative techniques. Able to							
Course		critically ev	aluate v	arious real li	ife situations	s by res	ortin	g to Analysis of	
		key issues and factors. Able to demonstrate various principles involved in							
		solving mathematical problems and thereby reducing the time take							
		performing job functions							
UNII-I		Chain Rule	e - Pipes	s and Cisteri	ns - 1 ime a	nd wor	К.		
		Chapters	15, 10, 1	/ of lext E	SOOK I	- 17-1			
UNII-II:		Boats and S	Streams	-Area and $-$	Surface are	a - voi	lume		
		Clocks Stock and Shares Dermutation and Combination							
UNIT-III: Clocks – Stock and Shares – Permutation a								nation.	
		Chapters 28, 29, 30 of Text Book 1           T         D:         (1)         (1							
UNIT-IV:		Man Out and series							
		Man Out a		5. 24-25 of To					
LINIT V.		Chapters 3	<u>, , , , , , , , , , , , , , , , , , , </u>	04, 35 01 1 e	XU BOOK I				
UNII-V:		NUN - VERBAL REASONING							
		Series – Analogy – Analytical Keasoning.							
Skills acquired	from this	Knowledg	$\mathbf{L}, \mathbf{L} \propto 4$	lom Solui	UK Z	tion1 of	hilitz	Drofossional	
Skills acquired	from uns	Compotence	$\mathbf{E}$ , FIOU	Solvi	ng, Anary	n ond T	onny Trong	formable Shill	
Decommonded	Toyt		y, FIOIe	1 Quantita	tina Antitud	li allu I	Tans		
Recommended	Text	I. DI.K.S.F	Aggarwa	ii, Quaninai hand & Cam	uve Apiliuu manu I tal 1	e jor Co	ompe alla:	2021	
			<i>ms</i> ,5.C	nanua Con	ipany Liu, I	New De	- 1111	2021.	
		2 Dr PS/	agomu	1 1 moder	Annroach	to Vark	hal &	Non workal	
		2. DI.K.S.F	nggaiwa	an, A mouerr	nany I ta N	low De	$\frac{1}{1}$	2 NOn - Verbul	
		Reasonii	<i>i</i> g, s.c.		pairy Liu, P		1111 -2	2013.	
Reference Boo	ks	1.Arun Sha	rma .O	uantitative A	Antitude M	c-Graw	hill 1	publications	
	***	2 Raiesh Varma "Fast Track Objective Arithmetic" Aribant							
		publication	IS.	11 <b>00</b> K	2 - Jeen e 1		, ,		
Website and		https://bool	ks.shun	vafoundation	n.com/book	c-quanti	itativ	e-aptitude-by-	
e-Learning Sou	urce	r-s-aggarw	al-publi	shedby-s-ch	and-englisl	n/dp/OI	DTR	GH2	

## **Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

CLO 1: solve the problems in Chain Rule, Pipes and Cisterns, and Time and work.

CLO 2: find the solution ofBoats and Streams, Area and Surface area and Volume.

CLO 3: evaluate the problems of Clocks, Stock and Shares, Permutation and Combination.

CLO 4: get the knowledge inTrue Discount, Banker's Discount, Height and Distance and

Odd Man Out and series.

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	3	1	2	3	3	3	3	2	1		
CLO2	2	1	3	2	3	3	3	2	1		
CLO3	2	3	1	3	3	3	3	2	1		
CLO4	1	3	2	3	3	3	3	2	1		
CLO5	3	2	3	1	3	3	3	2	1		

CLO 5: analyse about the Series , Analogy and Analytical Reasoning.

Note: Internal Examination only

			SEM	ESTER-II	Ι						
Title of the	e Course			COMPLE	EX ANALY	YSIS					
Paper Nu	nber	CORE VI	[								
Category	Core	Year	II	Credits	4	Cour	se	23MMA3C1			
		Semester	III			Code	ļ				
Instruction	nal Hours	Lecture	e T	utorial	Lab Prac	ctice		Total			
per week		4		1				5			
Pre-requis	site	UG level (	Complex A	nalysis							
Objectives	s of the	To Study	Cauchy	integral fo	ormula, loc	cal pro	opert	ties of analytic			
Course		functions, general form of Cauchy's theorem and evaluation of definite									
		integral and	integral and harmonic functions								
UNIT-I:		Cauchy's I	ntegral Fo	rmula: The	Index of a j	point w	vith re	espect to a closed			
		curve – Th	ne Integral	formula –	Higher deri	ivatives	s. Lo	cal Properties of			
		analytical F	unctions:			_					
		Removable	Singulari	ties-Taylors	s' Theoren	n – Ze	eros a	and poles – The			
		local Mapp	ing – The	Maximum I	rinciple.						
		Chapter 4	: Section 2	$\frac{2:2.1}{2.1}$ to $\frac{2.3}{2.1}$	3& Section	3:3.	I to S	<b>3.4</b>			
UNIT-II:		The gener	al form of	Cauchy's	Theorem	Chain	s and	d cycles- Simple			
		Continuity	- Homolo	gy - The G	eneral state	ement c	of Ca	uchy's Theorem			
		- Proof of	Cauchy's	theorem -	Locally e	xact d	iffere	entials- Multiply			
		connected	regions - R	esidue theor	rem - 1 he a	irgume	nt pr	inciple.			
		Chapter 4 : Section 4 : 4.1 to 4.7 & Section 5: 5.1 and 5.2									
UN11-111	•	Evaluation		Definite	Integr	ais		1 Harmonic			
		Functions	Evaluation	1 OI definito	e integrais	- Dei	[11111]	on of Harmonic			
		Chantar 4	a basic pro	perues - M	ean value p	1 to C	y - P( 2	oisson iormula.			
		Unapter 4	Eurotion	ord Down	uons o : o. • Savias Ex	<u>1 10 0.</u>	<u> </u>				
	•	Sobworz t	Functions	The reflecti	r Series Ex		oiora	stragg theorem			
		Taylor's Se	ries I au	rent series		C - W	cicis	suass meorem –			
		Chanter 4	• Sections	64 and $65$	& Section	s 1 1 ta	n 1 3				
LINIT_V.		Partial Fr	<u>actions</u> ar	d Entire F	Functions	<u>Partic</u>	al fre	actions - Infinite			
0111-7.		products -	Canonical	nroducts -	Gamma Fi	inction	11 110 1 <b>-</b> Iet	sen's formula _			
		Hadamard	s Theorem	n	Gainina i t		1 501	isen s formula			
		Chanter 5	Sections	2 1 to 2 4 8	& Sections	3 1 an	d 3 2	)			
Extended		Ouestions	related to	the abov	ve topics.	from	vario	ous competitive			
Profession	al	examinatio	ns UPSC	TRB / NF	T / UGC -	- CSIR	/ G	ATE / TNPSC /			
Componen	t (is a part	others to be	e solved	1100 / 1102		0.0111					
of internal	( <b>F</b>	(To be disc	ussed duri	ng the Tuto	rial hour)						
component	t only.				)						
Not to be in	ncluded										
in the Exte	rnal										
Examinatio	on										
question pa	aper)										
Skills acqu	ired from	Knowledg	e, Proble	m Solving	g, Analyti	ical a	abilit	y, Professional			
this course		Competence	y, Professi	onal Comm	unication a	nd <u>Tr</u> a	<u>insfe</u>	rrable Skill			

Recommended	Lars V. Ahlfors, Complex Analysis, (3rd edition) McGraw Hill Co.,
Text	New York, 1979
<b>Reference Books</b>	1. H.A. Presfly, <i>Introduction to complex Analysis</i> , Clarendon Press, oxford, 1990.
	2. J.B. Conway, <i>Functions of one complex variables</i> Springer - Verlag, International student Edition, Naroser Publishing Co.1978
	<ol> <li>E. Hille, Analytic function Thorey(2 vols.), Gonm&amp; Co, 1959.</li> <li>M.Heins, Complex function Theory, Academic Press, New</li> </ol>
	York,1968.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, http://en.wikipedia.org

**Course Learning Outcome (for Mapping with POs and PSOs)** Students will be able to

CLO1: Analyze and evaluate local properties of analytical functions and definite integrals.

**CLO2:** Describe the concept of definite integral and harmonic functions.

- CLO3: Demonstrate the concept of the general form of Cauchy's theorem
- CLO4: Develop Taylor and Laurent series .

CLO5 Explain the infinite products, canonical products and jensen'sformula.

		POs						PSOs		
	1	2	3	4	5	6	1	2	3	
CLO1	3	1	3	2	3	3	3	2	1	
CLO2	2	1	3	1	3	3	3	2	1	
CLO3	3	2	3	1	3	3	3	2	1	
CLO4	1	2	3	2	3	3	3	2	1	
CLO5	3	1	2	3	3	3	3	2	1	

Title of the Cou	rse				PROBABI	LITY THE	ORY				
Paper Number		CORE VI	Π								
Category Core	e	Year	I	Ι	Credits	4	Cour	rse	23MMA3C2		
		Semester	II	Ι			Code	e			
Instructional H	ours	Lectur	e	Т	utorial	Lab Prac	tice		Total		
per week		4	4 1								
Pre-requisite		UG level a	JG level algebra and calculus								
Objectives of	the	To introdu	To introduce axiomatic approach to probability theory, to study some								
Course		statistical of	tatistical characteristics, discrete and continuous distribution functions								
		and their p	and their properties, characteristic function and basic limit theorems of								
		probability	•								
UNIT-I:		Random <b>E</b>	lvents	and	Random V	ariables: F	Randoi	n eve	ents – Probability		
		axioms –	Comb	oinato	rial formul	ae – condi	tional	prot	bability – Bayes		
		Theorem -	- Inde	epend	lent events	– Randon	n Var	1able	$s - D_1 stribution$		
		Function -	- Join	t Dis	stribution –	Marginal	Distri	butio	n - Conditional		
		Distributio	n - li	ndepe	endent rand	om variabl	es –	Func	tions of random		
		variables.	<b>C</b> 4	• •	114 19						
		Chapter 1	: Secti	ions 1							
		Chapter 2	: Seci	tions	2.1 to 2.9	F			Level and the The		
UNII-11:		Chabyahay		une		on : Expe		n- N Ord	noments – The		
		Momenta	frond	lom	y – Auson	are moment	lls – the fir	Oru	d accord types		
		Chantar 3		tions	2 1 + 2 9	gression of	the III	st and	u second types.		
UNIT III.		Character 3	: Seci	funa	J.I 10 J.O	artics of	ahara	atoria	tia functions		
01111-111.		Characteris	isic fu	nction	ns and mon	vents _ sem	i inva	riant	s = characteristic		
		function	of th	e su	in of the	independ	lent i	rando	m variables –		
		Determinat	tion of	f dist	ribution fur	nction by the	ient i ie Ch	aracte	eristic function –		
		Characteris	stic f	functi	on of m	ultidimensi	onal	rand	om vectors –		
		Probability	gener	rating	functions.		onur	10110			
		Chapter 4	: Sect	tions	4.1 to 4.7						
UNIT-IV :		Some Pro	babili	tv di	stributions	: One poin	t, tw	o po	int , Binomial –		
		Polya – H	vperge	eomet	tric – Poisso	on (discrete	) distr	ibuti	ons – Uniform –		
		normal gar	nma –	Beta	– Cauchy a	nd Laplace	(conti	inuou	s) distributions.		
		Chapter 5	:Secti	ionS	5.1 to 5.10	-			, ,		
UNIT-V:		Limit The	eorem	I <b>S :</b> S	Stochastic c	onvergence	e – B	ernau	ılli law of large		
		numbers –	Conv	verger	nce of sequ	ence of dis	tributi	on fi	unctions – Levy-		
		Cramer Th	eorem	ns – d	e Moivre-L	aplace Theo	orem -	- Pois	sson, Chebyshev,		
		Khintchine	Weal	k law	of large nu	mbers – Li	ndberg	g The	orem – Lapunov		
		Theroem	– B	orel-	Cantelli Le	emma - K	olmog	gorov	Inequality and		
		Kolmogoro	ov Stro	ong L	aw of large	numbers.					
		Chapter 6	: Sect	tions	6.1 to 6.4, 6	5.6 to 6.9, 6	.11 an	nd 6.1	2.		
		(Omit Sec	tions (	6.5, 6	.10,6.13 to	6.15)					

Extended	Questions related to the above tonics from various competitive
Drafagianal	Questions related to the above topics, noni various competitive
Professional	examinations UPSC / IRB / NET / UGC – CSIR / GATE / INPSC / $(1 + 1 + 1 + 1 + 1)$
Component (is a part	others to be solved
of internal	(To be discussed during the Tutorial hour)
component only, Not	
to be included in the	
External	
Examination	
question paper)	
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional
this course	Competency, Professional Communication and Transferrable Skill
Recommended	M. Fisz, Probability Theory and Mathematical Statistics, John Wiley
Text	and Sons, New York, 1963.
<b>Reference Books</b>	1. R.B. Ash, Real Analysis and Probability, Academic Press, New
	York, 1972
	2. K.L.Chung, A course in Probability, Academic Press, New York,
	1974.
	4. R.Durrett, <i>Probability : Theory and Examples</i> , (2 <sup>nd</sup> Edition) Duxbury
	Press, New York, 1996.
	5. V.K.RohatgiAn Introduction to Probability Theory and Mathematical
	Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).
	6. S.I.Resnick, A Probability Path, Birhauser, Berlin, 1999.
	7. B.R.Bhat . Modern Probability Theory (3 <sup>rd</sup> Edition). New Age
	International (P)Ltd, New Delhi, 1999
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics.
e-Learning Source	http://www.opensource.org, http://www.probability.net

Students will be able to

**CLO1:** To define Random Events, Random Variables, to describe Probability, to apply Bayes, to define Distribution Function, to find Joint Distribution function, to find Marginal Distribution and Conditional Distribution function, to solve functions on random variables.

**CLO2:** To define Expectation, Moments and Chebyshev Inequality, to solve Regression of the first and second types.

**CLO3:** To define Characteristic functions, to define distribution function, to find probability generating functions, to solve problems applying characteristic functions

**CLO4:** To define One point, two-point, Binomial distributions, to solve problems of Hypergeometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions, to solve problems on Cauchy and Laplace distributions

**CLO5:** To discuss Stochastic convergence, Bernaulli law of large numbers, to elaborate Convergence of sequence of distribution functions, to prove Levy-Cramer Theorems and de Moivre-Laplace Theorems, to explain Poisson, Chebyshev, Khintchine Weak law of large numbers, to explain and solve problems on Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	3	1	3	2	3	3	3	2	1		
CLO2	2	1	3	1	3	3	3	2	1		
CLO3	3	2	3	1	3	3	3	2	1		
CLO4	1	2	3	2	3	3	3	2	1		
CLO5	3	1	2	3	3	3	3	2	1		

Title of the Course	TOPOLOGY									
Paper Number	CORE IX									
Category Core	Year	II	Credits	4	Course	<b>23MMA3C3</b>				
	Semester	III			Code					
Instructional Hours	Lecture		Futorial	Lab Pra	ctice	Total				
per week	4		1			5				
Pre-requisite	Real Analys	sis		•						
<b>Objectives</b> of the	To study	opologie	cal spaces,	continuous	functio	ns, connectedness,				
Course	compactness	, countal	bility and set	paration axi	oms.					
UNIT-I:	Topological	spaces	:Topologica	1 spaces –	Basis for	r a topology – The				
	order topolo	order topology – The product topology on $X \times Y$ – The subspace								
	topology – C	Closed se	ts and limit	points.		-				
	Chapter 2 :	Sections	s 12 to 17							
UNIT-II :	Continuous	functio	ns: Continu	ous functio	ns – the	product topology –				
	The metric to	The metric topology.								
	Chapter 2 :	Sections	s 18 to 21 (C	<b>)</b> mit Sectio	n 22)					
UNIT-III :	Connectedness: Connected spaces- connected subspaces of the Real									
	line – Components and local connectedness.									
	Chapter 3 :	Chapter 3 : Sections 23 to 25.								
UNIT-IV :	<b>Compactness</b> :Compact spaces – compact subspaces of the Real line – Lin									
	Point Compactness – Local Compactness.									
	Chapter 3 :	Sections	s 26 to 29.							
UNIT-V:	Countabilit	y and Se	paration A	kiom:						
	The Countal	oility Ax	ioms – The	separation	Axioms	– Normal spaces –				
	The Urysohn	n Lemma	ı – The Urys	ohnmetriza	tion Theo	orem – The Tietz				
	extension the	eorem.								
<b></b>	Chapter 4 :	Sections	<u>s 30 to 35.</u>			· · · · ·				
Extended	Questions 1	elated t	to the above	ve topics,	from va	arious competitive				
Professional	examination	s UPSC	/ TRB / NE	et / UGC -	– CSIR /	GATE / TNPSC /				
Component (1s a part	others to be	solved		• • • •						
of internal	(To be discu	ssed dur	ing the Tutor	rial hour)						
component only, Not										
to be included in the										
External										
Examination										
question paper)	77 1 1	D 11	<b>C</b> 1 ·	A 1 .	• 1 1	·1·. D C · 1				
Skills acquired from	Knowledge	Probl	$\stackrel{\text{em}}{\cdot}$ Solvin	g, Analyt	ical abi	ility, Professional				
this course	Competency	, Protess	sional Comm	unication a	ind Trans	Ierrable Skill				
Recommended	James R. M	unkres, <i>I</i>	$copology (2^{+})$	$\stackrel{-}{\cdot}$ Edition) I	earson E	ducation Pve. Ltd.,				
Text	Delhi-200	02 (Third	Indian Repi	nnt)						

<b>Reference Books</b>	1. J. Dugundji, <i>Topology</i> , Prentice Hall of India, New Delhi, 1975.
	2. George F.Sinmons, Introduction to Topology and Modern Analysis,
	McGraw Hill Book Co., 1963
	3. J.L. Kelly, General Topology, Van Nostrand, Reinhold Co., New
	York
	4. L.Steen and J.Subhash, Counter Examples in Topology, Holt,
	Rinehart and Winston, New York, 1970.
	5. S.Willard, General Topology, Addison - Wesley, Mass., 1970
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, http://en.wikipedia.org

Students will be able to

**CLO1:** Define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space. **CLO2:** Understand continuity, compactness, connectedness, homeomorphism and topological properties.

CLO3: Analyze and apply the topological concepts in Functional Analysis.

**CLO4:** Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a topological space.

**CLO5**: Develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent(homoeomorphic).

		POs						PSOs		
	1	2	3	4	5	6	1	2	3	
CLO1	3	1	3	2	3	3	3	2	1	
CLO2	2	1	3	1	3	3	3	2	1	
CLO3	3	2	3	1	3	3	3	2	1	
CLO4	1	2	3	2	3	3	3	2	1	
CLO5	3	1	2	3	3	3	3	2	1	

Title of the	Course			INDUSTRIA	L STATIS	STICS	INDUSTRIAL STATISTICS								
Paper Num	ıber	CORE X													
Category	Core	Year	II	Credits	3	Course C	ode								
		Semester	III			23MMA3	C4								
							1								
Instruction	al Hours	Lecture		Tutorial	Lab I	Practice	То	tal							
per week		4		1				5							
Pre-requisi	te	UG Level S	tatisti	CS											
Objectives	of the	To introduc	To introduce Statistical inference, sufficient statistics and learn the												
Course		Maximum li	keliho	od estimators and	l discuss tl	he theory of	statistica	ıl tests.							
UNIT-I:		Introduction	n to	statistical Infere	ence: Poin	nt estimatic	on – con	fidence							
		intervals for	mean	s – confidence in	tervals for	differences	of mean	ıs – test							
		of statistical	of statistical hypothesis – Additional comments about statistical tests –												
		Chi-Square t	ests.												
		Chapter - 6						<b>CC 1</b>							
UNIT-II		Sufficient S	tatist	ics: Measures of	Quality of	of Estimator	rs – a su	fficient							
		$\int_{1}^{1} \frac{1}{\sqrt{2}} \frac{1}{\sqrt{2}}$	parai	neter- properties	of a suffic	tient statisti	c - comp	letiness							
		and uniquent	ess the	e exponential clas	s of proba	ibility densi	ty – Tunc	tions of							
		a parameter.	. 5	tions 71 to 76											
LINIT III.		Chapter – /	: Sec	uons /.1 to /.0	Estimatio	n Fisher	Informat	ion and							
UN11-111:		the Rec. Cremer inequality Limiting Distributions of Maxim													
		Likelihood e	ctimat	tors Robust M	Fetimation	JISHIOUHOIK	5 01 IVIa	AIIIIUIII							
		Chanter – 8	Stiiia	.013. Robust 101 –1	Joimation	•									
UNIT-IV		Theory of st	atisti	cal tests: Certain	Best tests	– Uniforml	v most n	owerful							
		tests – Likeli	hood	Ratio Tests – the	sequential	l probability	Ratio Te	est.							
		Chapter – 9	:Sect	ions 9.1 to 9.4		. proceeding									
UNIT-V:		Inferences	abou	t Normal Mo	dels: The	e distributi	ons of	certain							
		Quadratic fo	rms –	A test of the equ	ality of se	veral means	– Nonce	entral $\chi^2$							
		and noncentr	ral F -	- multiple compa	risons – T	he analysis	of variar	nce - A							
		regression pi	oblen	n – A test of indep	pendence.	-									
		Chapter – 1	0 : Se	ctions – 10.1 to 1	0.7										
Extended		Questions r	elated	to the above	topics,	from vario	ous com	petitive							
Professional	1	examination	s UPS	SC / TRB / NET	/ UGC –	CSIR / GA	ATE / TI	NPSC /							
Component	(is a part	others to be s	solved	l											
of internal		(To be discu	ssed d	uring the Tutoria	l hour)										
component	only, Not														
to be includ	ed in the														
External															
Examination	n														
question par	per)	V	n	hlam Calain	• 1 •	aal al. 114	, D								
Skills acqui	irea Irom	Knowledge,	Pro Drof	Solving,	Analyti	cal ability	$h_{\rm h}$ Profe	essional							
<b>D</b> ocommon	dod Tort			Allon T. Croix I	troductica	to Mother	aution SKIII	otictica							
Necommen	ueu rext	Fifth Edition	iogg, n Doc	Alleli I. Craig, If	117000001101 2005	i to iviainem	iatical Sta	austics,							
			n, rea	uson Education, A	2003.										

Reference Books	<ol> <li>V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1998 (3<sup>rd</sup> Print)</li> <li>M.Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963</li> <li>Y. S. Chow and H. Teicher, Probability Theory, 2nd Edition, Springer Verlag, Berlin, 1988.</li> </ol>
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, http://www.probability.net

Students will be able to

**CLO 1:** learn Point estimation, confidence intervals for means, confidence intervals for differences of means and test of statistical hypothesis.

**CLO 2:** explain about the measures of Quality of Estimators and a sufficient statistic for a parameter– properties of a sufficient statistic.

**CLO 3:** discuss the Bayesian Estimation, Fisher Information and the Rao, Cramer inequality Limiting Distributions of Maximum Likelihood estimators.

**CLO 4:** understand theCertain Best tests, Uniformly most powerful tests and the Likelihood Ratio Tests – the sequential probability Ratio Test.

**CLO 5:** learn the distributions of certain Quadratic forms, Noncentral  $\chi^2$  and noncentral F – multiple comparisons and the analysis of variance – A regression problem – A test of independence.

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	2	2	1	3	3	3	3	2	1		
CLO2	2	1	3	1	3	3	3	2	1		
CLO3	2	3	1	3	3	3	3	2	1		
CLO4	1	2	1	2	3	3	3	2	1		
CLO5	2	1	3	2	3	3	3	2	1		

Title of the Cou	irse		AI	GEBRAIC	C NUMBEI	R THEO	RY			
Paper Number										
Category	DSE-VA	Year	II	Credits	3	Course	e 23MMA3E1			
		Semester	III			Code				
Instructional H	ours	Lecture	Г	utorial	Lab Prac	ctice Total				
per week		4	4 1 5							
Pre-requisite		UG level Algebra and Number theory								
Objectives of th	e Course	The aim of this course is to develop the knowledge in Algebraic Number								
		theory, particularly Rings, Fields, Modules, Conjugate, Discriminant,								
		Algebraic inte	egers, N	orms, trace	s, Quadratio	$\frac{1}{2}$ fields at	nd factorization.			
UNIT-I		Algebraic bac	k groui	nd : Rings a	nd Fields –	Factoriza	ation of Polynomials			
		– Field extensions – Symmetric polynomials – Modules – Free Abelian								
		groups.	· ·	11/ 1	(					
		Chapter 1 : S	bection:	$\frac{6 - 1.1 \text{ to } 1.0}{Comingota}$	0 and Disarin	inant	Alashusis integras			
UNII-11:		Algebraic numbers – Conjugate and Discriminant – Algebraic integ								
		Integral bases	Norr	5 2.1 10 2.3	e Pinas o	finteger	g			
UINI I -111		Chanter 2 : Sections 2.4 to 2.6								
		Ouadratic fields – Cyclotomic fields								
0111-17.		Chapter 3 · Sections 3.1 to 3.2								
UNIT-V:		Historical bac	kgroun	d – trivial fa	actorization	– factori	ization into			
		irreducible								
		Chapter 4 : S	Section	s 4.1 to 4.3						
Extended	Professional	Questions re	lated	to the abo	ove topics	, from	various competitive			
Component (is	a part of	examinations	UPSC	/ TRB / N	ET / ŪGC	– CSIR	/ GATE / TNPSC /			
internal comp	onent only,	others to be so	olved							
Not to be inclu	uded in the	(To be discuss	sed dur	ing the Tuto	rial hour)					
External I	Examination									
question paper)										
Skills acquired	from this	Knowledge,	Prob	lem Solvi	ng, Anal	ytical a	ability, Professional			
course		Competency,	Profess	sional Comr	nunication	and Tran	sferrable Skill			
Recommended	Text	I.Stewart and	D.Tall,	"Algebraic	number the	eory and	Fermat's Last			
		theorem (3rd	edition	), A.K Peter	s Ltd., Nati	ck.				
Reference Book	(S	1. Z. I. Borev:	ic and I	.R.Safarevio	e, Number t	heory, A	cademic Press, NY,			
		1966.	1 1	A T 11'1	A 1 1 ·	NT 1	.1 . 1 .			
		2. J.W.S.casse	ets and $\mathbf{V}_{2} = 1_{-1}$	A.Frohlich,	Algebraic,	Number	theory, Academic			
		Press, New	Y OrK,	.90/.	<b>W</b> 7:1	Nor V	ordr 1072			
		3. P. Kibenbo	ım, Alg	georate num	bers, whey	, new Y	UIK, 1972.			
Website and		http://www.ma	th.toron	to.edu/~ila/N	leukirch Ale	pebraic n	umber theory pdfhttps://			
e-Learning Sou	rce	/www.pdfdrive	e.com/do	wnload.pdf?	id=1889381	91&h=4d	0f9c871d3eb0			
t-Learning 500										

**Course Learning Outcome (for Mapping with POs and PSOs)** Students will be able to

**CLO 1:** define ring, field, Modules and polynomials. **CLO 2:** learn the algebraic numbers, Conjugate and Discriminant and Algebraic integers.

CLO 3: know the Integral bases, Norms and traces and Rings of integers.

CLO 4: the Quadratic fields and Cyclotomic fields.

	POs							PSOs		
	1	2	3	4	5	6	1	2	3	
CLO1	3	2	1	2	3	3	3	2	1	
CLO2	3	3	3	2	2	3	3	2	1	
CLO3	3	3	2	2	3	3	3	2	1	
CLO4	3	2	2	3	2	3	3	2	1	
CLO5	3	1	3	2	3	3	3	2	1	

CLO 5 :Historical background, trivial factorization and factorization into irreducible.

Category         DSE-V B         Year         II         Credits         3         Course Code         23MMA3E2           Instructional Hours per week         Lecture         Tutorial         Lab Practice         Total           Pre-requisite         UG level Mechanics         5         5           Objectives Course         of the         The aim of this course is to develop knowledge in fluid dynamics of real fluids, Ideal fluids, Velocity of a fluid at a point, Stream lines, path lines, Unsteady flows, The equation of Continuity, different types of equations, Sources, Sinks, Doublets Images in rigid infinite plane, Stoke's Stream Function, The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow, The Milne-Thomson Circle Theorem, The Coefficient of Viscosity, Laminar flow and The Navier-Stokes equation of a viscous fluid.           UNIT-I         Kinematics of fluids in motion: Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.           UNIT-II :         Equations of Motion of a Fluid: Huid.         Chapter 2: Sections 2 2.9           UNIT-II :         Some Three-Dimensional Flows: Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetry. Chapter 3: Sections 3.1, 3.2, 3.4 - 3.7, 3.9           UNIT-III :         Some Two-Dimensional Flows: Introduction - Sources, Sinks and Doublets Images in rigid infinite plan
Instructional Hours per week       Semester       III       Code         Instructional Hours per week       4       1        5         Pre-requisite       UG level Mechanics       5         Objectives       of       the       The aim of this course is to develop knowledge in fluid dynamics of real fluids, Ideal fluids, Velocity of a fluid at a point, Stream lines, path lines, Unsteady flows, The equation of Continuity, different types of equations, Sources, Sinks, Doublets Images in rigid infinite plane, Stoke's Stream Function, The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow, The Milne-Thomson Circle Theorem, The Coefficient of Viscosity, Laminar flow and The Navier-Stokes equation of a viscous fluid.         UNIT-I       Kinematics of fluids in motion: Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.         UNIT-II :       Equations of Motion of a Fluid: Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation - Worked Examples - Discussion of the case of steady motion under Conservative Body Forces -Some flows involving axial symmetry.         UNIT-III       Some Three-Dimensional Flows: Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetric flows - Stoke's Stream Function.         UNIT-IV :       Sone Two-Dimensional Flows: The Kream Function.
Instructional Hours per week         Lecture         Tutorial         Lab Practice         Total           Pre-requisite         UG level Mechanics
per week         4         1          5           Pre-requisite         UG level Mechanics         UG level Mechanics         Image: Course of Course         The aim of this course is to develop knowledge in fluid dynamics of real fluids, Ideal fluids, Velocity of a fluid at a point, Stream lines, path lines, Unsteady flows, The equation of Continuity, different types of equations, Sources, Sinks, Doublets Images in rigid infinite plane, Stoke's Stream Function, The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow, The Milne-Thomson Circle Theorem, The Coefficient of Viscosity, Laminar flow and The Navier-Stokes equation of a viscous fluid.           UNIT-I         Kinematics of fluids in motion: Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.           UNIT-II :         Equations of Motion of a Fluid: Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation - Worked Examples - Discussion of the case of steady motion under Conservative Body Forces -Some flows involving axial symmetry.           UNIT-III         Some Three-Dimensional Flows: Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetric flows - Stoke's Stream Function.           UNIT-IV :         Some Two-Dimensional Flows: The Stream Function.         The Complex Velocity Potential for Two - Two
Pre-requisite       UG level Mechanics         Objectives       of       the       The aim of this course is to develop knowledge in fluid dynamics of real fluids, Ideal fluids, Velocity of a fluid at a point, Stream lines, path lines, Unsteady flows, The equation of Continuity, different types of equations, Sources, Sinks, Doublets Images in rigid infinite plane, Stoke's Stream Function, The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow, The Milne-Thomson Circle Theorem, The Coefficient of Viscosity, Laminar flow and The Navier-Stokes equation of a viscous fluid.         UNIT-I       Kinematics of fluids in motion:         Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.         UNIT-II :       Equations of Motion of a Fluid:         Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation - Worked Examples - Discussion of the case of steady motion under Conservative Body Forces -Some flows involving axial symmetry.         UNIT-III       Some Three-Dimensional Flows:         Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetric flows - Stoke's Stream Function.         Chapter 4: Sections 4.1 - 4.5         UNIT-IV :       Some Two-Dimensional Flows:
Objectives Courseof thethe The aim of this course is to develop knowledge in fluid dynamics of real fluids, Ideal fluids, Velocity of a fluid at a point, Stream lines, path lines, Unsteady flows, The equation of Continuity, different types of equations, Sources, Sinks, Doublets Images in rigid infinite plane, Stoke's Stream Function, The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow, The Milne-Thomson Circle Theorem, The Coefficient of Viscosity, Laminar flow and The Navier-Stokes equation of a viscous fluid.UNIT-IKinematics of fluids in motion: Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.UNIT-II :Equations of Motion of a Fluid: Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation - Worked Examples - Discussion of the case of steady motion under Conservative Body Forces -Some flows involving axial symmetry. Chapter 3: Sections 3.1, 3.2, 3.4 - 3.7, 3.9UNIT-IIISome Three-Dimensional Flows: Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetric flows - Stoke's Stream Function. Chapter 4: Sections 4.1 - 4.5UNIT-IV :Some Two-Dimensional Flows: The Stream Function - The Complex Velocity Potential for Two -
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Image: Navier-Stokes equation of a viscous fluid.         UNIT-I       Kinematics of fluids in motion: Real fluids and Ideal fluids - Velocity of a fluid at a point - Stream lines and path lines - Steady and Unsteady flows – The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change – The equation of Continuity - Worked Examples - Acceleration of a Fluid.         Chapter 2: Sections 2 2.9         UNIT-II :       Equations of Motion of a Fluid: Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation - Worked Examples - Discussion of the case of steady motion under Conservative Body Forces -Some flows involving axial symmetry.         Chapter 3: Sections 3.1, 3.2, 3.4 - 3.7, 3.9         UNIT-III       Some Three-Dimensional Flows: Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetric flows - Stoke's Stream Function.         UNIT-IV :       Some Two-Dimensional Flows: The Stream Function - The Complex Velocity Potential for Two -
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Stream Function.         Chapter 4: Sections 4.1 - 4.5         UNIT-IV :         Some Two-Dimensional Flows:         The Stream Function - The Complex Velocity Potential for Two -
Chapter 4: Sections 4.1 - 4.5         UNIT-IV :       Some Two-Dimensional Flows:         The Stream Function - The Complex Velocity Potential for Two -
UNIT-IV: Some Two-Dimensional Flows: The Stream Function - The Complex Velocity Potential for Two -
The Stream Function - The Complex Velocity Potential for Two -
The stream function the complex velocity foundaries in
Dimensional Irrotational, Incompressible Flow - Complex Velocity -
Potentials for Standard Two-Dimensional Flows - Some Worked -
Examples - Two Dimensional Image Systems - The Milne-Thomson -
Circle Theorem.
UNIT V. Vincer Electric
UNII-V: Viscous Fluid: Stragg components in a real fluid – Balation hatwach Contagion
Stress components in a real fluid - Kelation between Cartestan -
Coefficient of Viscosity and Laminar flow. The Navier Steles
equation of a viscous fluid - Some solvable problems in viscous flow
Steady motion between parallel planes only
Steary motion between paranet planes only.

Extended Professional	Questions related to the above topics, from various competitive
Component (is a part of	examinations OFSC / TKB / NET / OOC – CSIK / GATE / TNFSC /
internal component	others to be solved
only, Not to be included	(To be discussed during the Tutorial hour)
in the External	
Examination question	
paper)	
Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional
course	Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Frank Chorlton, Textbook of Fluid Dynamics, CBS Publishers &
	Distributors, 2004.
<b>Reference Books</b>	1.E.Karuse, Fluid Mechanics with Problems and Solutions, Springer,
	2005.
	2.R.W.Fox and A.T.McDonald, Introduction to Fluid Mechanics,
	Wiley, 1985.
Website and	http://www.math.toronto.edu/~ila/Neukirch_Algebraic_number_theory.pdfhtt
e-Learning Source	ps://www.pdfdrive.com/download.pdf?id=188938191&h=4d0f9c871d3eb0

Students will be able to

CLO 1: teach the Real fluids and Ideal fluids ans derive the the equation of Continuity.

**CLO 2:** explain about pressure at a point in a fluid at rest, Euler's equations of Motion, Bernoulli's equation.

- **CLO 3:** define Sources, Sinks, Doublets Images in rigid infinite plane, Axis symmetric flows and Stoke's Stream Function.
- **CLO 4**: work the Stream Function, Complex Velocity, Potentials for Standard Two Dimensional Flows and derive the Milne-Thomson Circle Theorem.
- **CLO 5:** derive the Stress components in a real fluid, Components of Stress, Translational motion of fluid element, The Coefficient of Viscosity, Laminar flow and The Navier-Stokes equation of a viscous fluid.

	POs							PSOs		
	1	2	3	4	5	6	1	2	3	
CLO1	1	2	3	2	3	3	3	2	1	
CLO2	2	2	3	3	3	3	3	2	1	
CLO3	2	3	3	2	3	3	3	2	1	
CLO4	2	2	3	2	3	3	3	2	1	
CLO5	1	2	3	3	3	3	3	2	1	

Title of the	Course	STOCHASTIC PROCESSES									
Paper Num	lber										
Category	Elective	Year	II	Credits	3	Cour	rse	23MMA3E3			
		Semester	III			Code	e				
Instruction	al Hours	Lecture	Т	utorial	Lab Prac	etice		Total			
per week		4		1				5			
Pre-requisi	te	UG level I	UG level Probability concepts								
Objectives	of the	Acquire the	e knowl	edge about 1	the concept	of Ma	ırkov	' Chain and			
Course		Queuing sy	vstem. U	Inderstand t	he methods	of bir	th an	d death queues			
		with finite	and infi	nite capacity	y. Develop	the ab	oility	of Standard			
		Brownian I	Motion								
UNIT-I		Stochastic	Process	ses:							
		Some notic	ons – Sp	ecification of	of Stochasti	c proc	esses	s – Stationary			
		processes -	Marko	v Chains – I	Definitions	and ex	kamp	oles – Higher			
		Transition	probabil	lities – Gene	eralization	of inde	epend	lent Bernoulli			
		trails.					-				
		Chapter 2	<u>&amp;3: Se</u>	ctions 2.1 to	o 2.3 and 3	.1 to 3	.3				
UNIT-11 :		Markov ch	ains:	. 11	• 14			CTT' 1			
		Classificati	on of st	ates and cha	uns – deteri	minatio	on of	i Higher			
		transition p	robabili	ties – stabil	ity of a Ma	rkov sy	ysten	n – Reducible			
		chains – Markov chains with continuous state space.									
		Unapter 5 Sections: 5.4 to 5.6, 5.8, 5.9,5.11 Markov processes with Discrete state space:									
UN11-111		Poisson processes and their extensions – Poisson process and related									
		Poisson processes and their extensions – Poisson process and related									
		distribution – Generalization of Poisson process- Birth and Death									
		process – Markov processes with discrete state space (continuous time									
		Warkov Chains) Chapter 4: Sections 4.1 to 4.5									
			Section								
UNIT-IV :		Renewal p	rocesse	s and Theo	rv:						
		Renewal p	ocess –	Renewal pr	ocesses in	contin	uous	time – Renewal			
		equation –	stopping	g time – Ŵa	ld's equation	on – R	enew	val theorems.			
		Chapter 6	:Section	ns 6.1 to 6.5	5						
UNIT-V:		Branching	Proces	ses:							
		Introductio	n – Prop	perties of ge	nerating fu	nction	s of l	Branching			
		process – P	robabili	ity of extinc	tion – Distr	ibutio	n of 1	the total number			
		of progeny	- Cond	itional Limi	t Laws due	to Ko	lmog	grov and due to			
		Yaglom – O	Classica	l Galton-Wa	atson Proce	ss - Be	ellma	in-Harris Process.			
		Chapter 9	:Section	ns 9.1 to 9.8	8						
Extended	Professional	Questions	ons related to the above topics, from various competitive								
Component	(1s a part of	examinatio	ns UPS	C / TRB / N	NET / UGC	z - CS	IR /	GATE / TNPSC /			
internal component others to be solved											
only, Not to	be included	(To be discussed during the Tutorial hour)									
in the	External										
Examination	n question										
paper)											

Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional									
course	Competency, Professional Communication and Transferrable Skill									
<b>Recommended Text</b>	J. Medhi, Stochastic Processes, 2 <sup>nd</sup> edition, Wiley Eastern, June 1987.									
<b>Reference Books</b>	1. Samuel Karlin, Howard M. Taylor, A first course in stochastic									
	processes, Academic press, Second Edition, 1975.									
	2. Narayan Bhat, Elements of Applied Stochastic Processes, John									
	Wiley, 1972.									
	3. S.K. Srinivasan and K. Mehata, Stochastic Processes, Tata									
	McGraw Hill, 1976.									
	4. N.V. Prabhu, Stochastic Processes, Macmillan (NY).									
Website and	http://home.ustc.edu.cn/~alex2014/SPpdf/Stochastic%20Processes%2									
e-Learning Source	<u>0SM</u> .									
	https://www.pdfdrive.com/download.pdf?id=187079740&h=9e25b15									
	<u>2bf6e3c</u>									

**Course Learning Outcome (for Mapping with POs and PSOs)** Students will be able to

**CLO 1:** study the specification of Stochastic processes, Stationary processes and Markov Chains

**CLO 2:** understand the concepts of classification of states and chains, stability of a Markov system and Markov chains with continuous state space.

**CLO 3:** learn the Poisson processes and their extensions, Birth and Death process and Markov processes with discrete state space (continuous time Markov Chains)

**CLO 4** : define the Renewal process, Renewal processes in continuous time and Renewal Equation.

**CLO 5**: study the Properties of generating functions of Branching process, Probability of extinction and Distribution of the total number of progeny.

			PO	PSOs					
	1	2	3	4	5	6	1	2	3
CLO1	2	3	1	2	3	3	3	2	1
CLO2	1	2	3	1	3	3	3	2	1
CLO3	2	3	2	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	1	2	3	1	3	3	3	2	1

# SKILL ENHANCEMENT COURSE : (Internal Paper)

Title of the Course			MATLAB an Introduction								
Paper Number											
Category SEC	Year	II	Credits	2	Cour	se	23MMA3SP				
	Semester	III			Code	,					
Instructional Hours	Lecture	]	Tutorial	Lab Pra	ctice		Total				
per week	3		-				3				
Pre-requisite	UG level N	/lathem	atics								
Objectives of the	This course	provic	les basic fun	damentals	on MA	TLA	B, primarily for				
Course	numerical c	omput	ing. To lear	n the charac	eteristic	s of	script files,				
	functions an	nd func	tion files, tw	vo-dimensi	onal pl	ots a	nd three-				
	dimensiona	l plots.	To enhance	the progra	mming	, skil	ls with the help				
	of MATLA	B and	its features v	which allow	v to lear	rn ar	nd apply				
	specialized	specialized technologies.									
Course Outline	UNIT- I										
	Starting wit	h Matl	ab - Creatin	g arrays - N	/lathem	atica	al operations with				
	arrays.										
	(Chapters	: 1, 2, 3	3)								
	UNIT-II :										
	Script files - Functions and function files.										
	(Chapters : 4, 6)										
	UNIT-III										
	Two-dimensional plots - Three-dimensional plots.										
	(Chapters	: 5, 9)									
	UNIT-IV :	:									
	Programmi	ng in N	IATLAB.								
	(Chapter :	7)									
	UNIT – V										
	Polynomial	s, Curv	e fitting and	l interpolati	ion - Aj	pplic	cations in				
	numerical a	nalysis									
	(Chantars)	8 0)									
Skills acquired from this	Knowledge	<u>, 7</u> e. Pro	blem Solv	ing. Anal	vtical	abil	ity. Professional				
course	Competenc	v. Prof	essional Con	nmunicatio	on and '	Tran	sferrable Skill				
Recommended Text	"MATLAR	An In	troduction w	vith Applics	ation" <sup>1</sup>	ov A	. Gilat, John				
	Wiley & Sc	ons. Sir	igapore, 200	4.		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
		, 011	o-p-10, 200								
Website and	http://mirro	rs.ctan	.org/info/lsh	ort/english	/lshort.	pdf					
e-Learning Source	https://wwv	v.tug.o	rg/twg/mact	ex/tutorials	/ltxprir	ner-	1.0.pdf				

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

- CLO 1: Understand basic concepts of Text formatting and MATLAB file
- CLO 2: Demonstrating command names and arguments, Special characters.
- CLO 3: Apply the commands to create document layout and displayed output
- CLO 4: Create Table, Printing Text, Foot notes and marginal notes
- CLO 5 : Apply MATLAB commands to mathematical formulae

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	1	2	3	2	3	3	3	2	1
CLO2	2	2	3	2	3	3	3	2	1
CLO3	2	2	3	3	3	3	3	2	1
CLO4	1	3	3	3	3	3	3	2	1
CLO5	1	2	3	2	3	3	3	2	1

Note: Internal Examination only

Title of the	Course	SUB	JECT	<b>IVE SKIL</b>	LS IN MA	THEN	<b>IAT</b>	ICS – I		
Category	AECC	Year	II	Credits	2	Cour	se	23MMA3AP		
		Semester	III			Code	:			
Instruction	al Hours	Lecture	T	utorial	Lab Prac	tice		Total		
per week		2		-				2		
Pre-requisi	te	Basic Mathe	matics			I				
Objectives	of the	To update th	ne skill	s of Abstra	ct Algebra,	Linear	Alge	ebra, Differential		
Course		equations, Sec	quences	s and series a	and Real Ana	alysis.	C	, ,		
UNIT-I		ABSTRACT	Γ ALG	EBRA :						
		Groups -Sul	ogroup	s – Cyclic	Groups –	Cos	ets a	and Lagrange's		
		Theorem -Normal Subgroups and Quotient Groups – Isomorphism –								
		Homomorphism -Rings - Isomorphism - Types of rings -								
		Characteristi	c of a	a ring – S	Subrings –	Ideals	(	Quotient rings-		
		Maximal and	d Prin	ne Ideals -	Homomor	phism	of r	ings – Field of		
		quotients of	an Inte	gral domain	n.					
UNIT-II:		LINEAR AI	LGEB	RA:						
		Vector Space	es –	Subspaces -	– Linear Ti	ransfor	mati	on – Span of a		
		set- Linear	Indep	endence –	Basis and	Dime	ensio	n – Rank and		
		Nullity-Matr	ix of a	ı Linear Tra	ansformatio	n – Ini	ner I	Product Space –		
		Definition	and	examples	– Ortho	ogonali	ty	– Orthogonal		
		complement-	-Algeb	ra of Matri	ces – Types	s of Ma	atrice	s – The inverse		
		of a matrix - Elementary Transformations - Rank of a Matrix-								
		Simultaneous linear equations- Characteristic Equation and Cayley								
		– Hamilton t	heoren	n Eigen val	ues and Eig	gen Vec	ctors.			
UNIT-III :		DIFFERENTIAL EQUATIONS								
		Exact Differential Equations – Equations of the first order but of								
		higher degree – Equations solvable for p, x, y, clairaut's form								
		-Linear Equ	ation	with consta	int coefficie	ents-Li	near	equations with		
		variable coel	tricient	ts – Equation	ons reducib	le to th	ne lin	lear equations –		
		Simultaneou	S DIII	Prential Equ	ations - Fi	rst orde	er an	a first degree –		
		Simultaneou	s linea	r Differenti	al Equation	s - Me	etnoa	of variation of		
		sequencies.		D SEDIES	1					
		SEQUENCI	LO AIN	D SERIES	lancas	Monot	tonic	sequences		
		Convergent		nces Div	vergent and		llatin	a sequences		
		Cauchy sear	iences	- infinite of	series – Co	mnaris	naun son t	rest _Kummer's		
		Cauchy sequences – infinite series – Comparison test –Kummer's								
		series – Absolute convergence								
UNIT-V·		REAL ANA	LYSI	S	•					
		Sets and fur	nctions	. – Countal	ole and Un	counta	ble	sets – Metric		
		spaces – Boi	inded	sets – One	n sets - Sul	bspace	— In	terior of a set –		
		Closed sets -	– Clos	ure – limit	point – De	nse set	ts – (	Completeness –		
		Continuity –	Home	omorphism	– Uniform	o contir	nuitv	-Connectedness		
		– Compact N	Aetric :	spaces – Co	mpact subs	ets of l	R.			
		·		-	•					

#### ABILITY ENHANCEMENT COURSE: (Internal Paper)

Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional
course	Competency, Professional Communication and Transferrable Skill
<b>Reference Books</b>	Under Graduate Books
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, http://en.wikipedia.org

Students will be able to

**CLO 1:** learn the concepts of Abstract Algebra.

CLO 2: understand the concepts of Linear Algebra.

- CLO 3: solve the problems in Differential equation.
- CLO 4: analysisthe concepts of Sequences and series.
- CLO 5: understand the concepts of Real Analysis.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	1	2	3	3	3	3	2	1
CLO2	2	1	3	2	3	3	3	2	1
CLO3	2	3	1	3	3	3	3	2	1
CLO4	1	3	2	3	3	3	3	2	1
CLO5	3	2	3	1	3	3	3	2	1

**Note: Internal Examination only** 

				SEMESTER	-IV				
Title of	the			FUNCTIO	NAL ANA	ALYSIS	)		
Course									
Paper		CORE XI							
Number					1	1			
Catego	Cor	Year	II	Credits	4	Cours	e	23MMA4C1	
ry	e	Semester	IV						
Instruct	ional	Lecture	Lecture Tutorial Lab Practice Tota						
Hours		4		1				5	
per weel	K								
Pre-requ	iisite	Elements of R	leal Ana	lysis					
Objectiv	es of	To provide stu	idents w	ith a strong fou	undation in	functio	nal ana	alysis,	
the Cour	rse	focusing on sp	paces, op	erators and fur	ndamental	theorem	s. To c	develop	
		student's skill	s and co	nfidence in ma	thematical	analysis	s and p	proof	
		techniques.							
UNIT-I	:	<b>Banach Spac</b>	es: The c	definition and s	some exam	ples – C	Continu	ious linear	
		transformation	ns – The	Hahn-Banach	theorem-	The nat	ural in	nbedding of N in	
		$N^{**}$ - The oper	ı mappin	g theorem – T	he conjugat	te of an	Operat	tor.	
		Chapter 9:Se	ctions 4	6-51					
UNIT-II	:	Hilbert Spac	es:The d	efinition and s	ome simple	e proper	ties–		
		Orthogonalco	mplemer	nts–Ortho norn	nal sets–Th	ie conju	gate sp	bace <i>H</i> *-The	
		adjoint of an o	operator-	-self-adjoint op	perators-No	ormal an	d unita	ary operators –	
		Projections.							
		Chapter10:S	ections5	2-59					
UNIT-II	I :	Finite-Dimen	isional S	pectral Theor	y: Matrice	s – Dete	ermina	nts and the	
		spectrum of a	n operato	or –The spectra	al theorem.				
		Chapter 11:S	bections	60-62					
UNIT-IV	/:	General Prel	iminarie	es on Banach	Algebras:7	The defin	nition	and some	
		examples – R	egular ar	nd singular elen	ments – To	pologic	al divis	sors of zero –	
		The spectrum	– The fo	ormula for the	spectral rac	lius– Th	e radio	cal and semi-	
		simplicity.							
		Chapter 12:S	bections (	64-69					
UNIT-V	:	The Structur	e of Cor	nmutative Ba	nach Algel	bras: Tl	ne Geli	fand mapping –	
		Application o	f the form	nula <b>r(x) = li</b> r	n   x <sup>n</sup>    <sup>*/</sup> n	- Involu	tions in	n Banach	
		algebras-The	Gelfand-	Neumark theo	rem.				
		Chapter 13:S	ections	70-73					

Extended	Questions related to the above topics, from various competitive examinations
Professional	UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
Component	(To be discussed during the Tutorial hour)
(is a part of	
internal	
component	
only, Not to	
be included in	
the External	
Examination	
question	
paper)	
Skills	Knowledge, Problem Solving, Analytical ability, Professional Competency,
acquired from	Professional Communication and Transferrable Skill
this course	
Recommend	G.F.Simmons,IntroductiontoTopologyandModernAnalysis,McGrawHillEduca
ed Text	tion(India)Private Limited, New Delhi, 1963.
Reference	
Reference Books	1. W.Rudin, Functional Analysis, McGraw Hill Education (India)Private
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International, 1996.</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice U.B. Challer and G. Pedrick, First course in Functional Analysis, Prentice</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International, 1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi, 1987.</li> <li>E. Kreyszig, Introductory Functional Analysis with Applications, John Will and C. New York 1070.</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.</li> <li>E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley &amp; Sons, NewYork, 1978.</li> <li>M. Thember, Nair, Functional Analysis, A. First, course, Prantice, Hell, of</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.</li> <li>E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley &amp; Sons, NewYork, 1978.</li> <li>M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, NewDelhi, 2002</li> </ol>
Reference Books	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.</li> <li>E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley &amp; Sons, NewYork, 1978.</li> <li>M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, NewDelhi, 2002.</li> </ol>
Reference Books Website and	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.</li> <li>E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley &amp; Sons, NewYork, 1978.</li> <li>M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, NewDelhi, 2002.</li> </ol>
Reference Books Website and e-Learning	<ol> <li>W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.</li> <li>B.V. Limaye, Functional Analysis, New Age International,1996.</li> <li>C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.</li> <li>E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley &amp; Sons, NewYork, 1978.</li> <li>M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, NewDelhi, 2002.</li> <li>http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, http://en.wikiepedia.org</li> </ol>

Students will be able to

CLO1:Understand the Banach spaces and Transformations on Banach Spaces.

CLO2:Prove Hahn Banach theorem and open mapping theorem.

CLO3:Describe operators and fundamental theorems.

CLO4: Validate orthogonal and orthonormal sets.

CLO5: Analyze and establish the regular and singular elements.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the	e Course	DIFFERENTIAL GEOMETRY									
Paper Nun	nber	CORE XI	[								
Category	Core	Year	1	II	Credits	4	Cou	rse	23MMA4C2		
		Semester	Ι	V			Cod	e			
Instruction	nal Hours	Lecture	9	T	utorial	Lab Prac	ctice		Total		
per week		4			1				5		
Pre-requis	ite	Linear Algebra concepts and Calculus									
Objectives	of the	This cours	se int	roduc	es space cu	rves and th	neir in	trinsi	c properties of a		
Course		surface and	d geo	odesic	s. Further t	the non-int	rinsic	prop	erties of surface		
		and the dif	feren	tial ge	ometry of s	urfaces are	explo	red			
UNIT-I:		Space cur	ves:	Defin	ition of a s	space curve	e - A	rc ler	ngth – tangent –		
		normal and	l bin	ormal	<ul> <li>– curvature</li> </ul>	and torsio	n - co	ontact	t between curves		
		and surfa	ces-	tange	ent surface	- involute	s and	d eve	olutes- Intrinsic		
		equations -	- Fun	damei	ntal Existen	ce Theorem	n for s	pace of	curves- Helies.		
		Chapter I	: Sec	tions	<u>1 to 9</u>	<b>D</b> (* · · ·	0	0			
UNIT-11 :		Intrinsic p	rope	erties	of a surface	e: Definitio	n  of  a	surta	ace – curves on a		
		surface –	Suri		of revolution	n - Hello	colds	- N	letric- Direction		
		coefficient	s – 1	amilie	es of curves	s- Isometri	c corr	espoi	ndence- Intrinsic		
		Charter H. Sasting 1 to 0									
		Chapter II: Sections I to 9									
		property of geodesics - Canonical geodesic equations - Normal									
		Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature-									
		surface of constant curvature									
		Chanter I	I: Sections 10 to 18								
UNIT_IV ·		Non Intri	sic n	roner	10 10 10 ties of a su	rface					
		The second fundamental form- Principle curvature – Lines of curvature									
		- Developable - Developable associated with space curves and with									
		curves on s	urfac	e - M	inimal surfa	ces – Ruleo	d surfa	aces.			
		Chapter III: Sections 1 to 8									
UNIT-V:		Differentia	al Ge	ometi	ry of Surfac	ces :					
		Compact	surfa	ces v	whose poin	ts are um	blics-	Hill	bert's lemma –		
		Compact s	urfac	e of	constant cu	rvature – (	Comp	lete s	surface and their		
		characteriz	ation	– Hil	bert's Theor	em – Conj	ugate	points	s on geodesics.		
		Chapter I	V:S	Section	ns 1 to 8						
Extended		Questions	relat	ted to	the abov	e topics,	from	vari	ous competitive		
Professiona	al	examinatio	ns U	PSC /	TRB / NE	T / UGC -	- CSII	R / G	ATE / TNPSC /		
Component	t (is a part	others to be	e solv	ved	1 <b>T</b>	• 1 1 \					
of	internal	(To be disc	usse	d durii	ng the Tutor	nal hour)					
component	only, Not										
LO DE INCLU	uea in the										
External	'n										
Examination	)II (mer)										
question pa	iper)										

Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional								
this course	Competency, Professional Communication and Transferrable Skill								
Recommended	T.J.Willmore, An Introduction to Differential Geometry, Oxford								
Text	University Press,(17 <sup>th</sup> Impression) New Delhi 2002. (Indian Print)								
<b>RefereEce Books</b>	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. Wilhelm Klingenberg: A course in Differential Geometry, Graduate								
	Texts in Mathematics, Springer-Verlag 1978.								
	4. J.A. Thorpe Elementary topics in Differential Geometry, Under-								
	graduate Texts in Mathematics, Springer - Verlag 1979.								
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,								
e-Learning Source	http://www.opensource.org, www.physicsforum.com								

Students will be able to

**CLO1:**Explain space curves, Curves between surfaces, metrics on a surface, fundamental form of a surface and Geodesics.

**CLO2**:Evaluate these concepts with related examples.

CLO3:Compose problems on geodesics.

CLO4:Recognize applicability of developable.

CLO5:Construct and analyze the problems on curvature and minimal surfaces

	POs						PSOs				
	1	2	3	4	5	6	1	2	3		
CLO1	3	1	3	2	3	3	3	2	1		
CLO2	2	1	3	1	3	3	3	2	1		
CLO3	3	2	3	1	3	3	3	2	1		
CLO4	1	2	3	2	3	3	3	2	1		
CLO5	3	1	2	3	3	3	3	2	1		
Title of the Course		MF	MECHANICS								
-----------------------	------------------	--	----------------	-------------	--------------------	--	--	--	--	--	--
Paper Number	CORE XIII										
Category Core	Year	II Credits	4	Course	23MMA4C3						
	Semester	IV		Code							
Instructional Hours	Lecture	Tutorial	Lab Prac	ctice	Total						
per week	4	1			5						
Pre-requisite	UG level Calc	UG level Calculus and Differential equations.									
Objectives of the	To study mee	hanical systems	under gene	ralized co	ordinate systems,						
Course	virtual work, e	rtual work, energy and momentum, to study mechanics developed by									
	Newton, Lang	ange, Hamilton	Jacobi and '	Theory of	Relativity due to						
	Einstein.	nstein.									
UNIT-I:	Mechanical Sy	stems : The Mec	hanical system	em- Gener	alised coordinates						
	– Constraints -	Virtual work - E	nergy and M	Iomentum							
	Chapter 1 : Se	ctions 1.1 to 1.5									
UNIT-II :	Lagrange's Eq	uations: Deriva	tion of Lagr	ange's equ	ations-						
	Examples- Inte	grals of motion.									
	Chapter 2 : So	ections 2.1 to 2.3									
UNIT-III :	Hamilton's Ec	uations : Hamil	ton's Princip	ole - Ham	ilton's Equation -						
	Other variation	al principle.									
	Chapter 4 : Se	ctions 4.1 to 4.3									
UNIT – IV :	Hamilton-Jaco	obi Theory :									
	Hamilton Princ	iple function – H	amilton-Jaco	obi Equatic	on - Separability						
	Chapter 5 : Se	ctions 5.1 to 5.3									
UNIT-V :	Canonical Trar	sformation : Dif	ferential form	ms and ger	nerating functions						
	– Special Trans	formations– Lag	ange and Po	oisson brac	kets.						
	Chapter 6 : Se	ctions 6.1 to 6.3									
Extended	Questions rela	ited to the abo	ve topics,	from var	rious competitive						
Professional	examinations U	JPSC / TRB / N	ET / UGC -	- CSIR / C	GATE / TNPSC /						
Component (is a part	others to be sol	ved									
of internal	(To be discusse	ed during the Tuto	orial hour)								
component only, Not											
to be included in the											
External											
Examination											
question paper)											
Skills acquired from	Knowledge,	Problem Solvin	ng, Analyt	ical abili	ity, Professional						
this course	Competency, P	rotessional Com	nunication a	nd Transfe	errable Skill						
Recommended	D. Greenwood	, Classical Dynai	nics, Prentic	e Hall of	India, New Delhi,						
Text	1985.										

<b>Reference Books</b>	1. H. Goldstein, Classical Mechanics, (2 <sup>nd</sup> Edition) Narosa Publishing
	House, New Delhi.
	2. N.C.Rane and P.S.C.Joag, Classical Mechanics, Tata McGraw Hill,
	1991.
	3. J.L.Synge and B.A.Griffth, Principles of Mechanics (3rd Edition)
	McGraw Hill Book Co., New York, 1970.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, www.physicsforum.com

## **Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO1:** Demonstrate the knowledge of core principles in mechanics.

CLO2:Interpret and consider complex problems of classical dynamics in a systematic way.

CLO3: Apply the variation principle for real physical situations.

**CLO4:**Explore different applications of these concepts in the mechanical and electromagnetic fields.

**CLO5**:Describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	3	1	3	2	3	3	3	2	1		
CLO2	2	1	3	1	3	3	3	2	1		
CLO3	3	2	3	1	3	3	3	2	1		
CLO4	1	2	3	2	3	3	3	2	1		
CLO5	3	1	2	3	3	3	3	2	1		

Title of the	Course	ADVANCED NUMERICAL ANALYSIS									
Paper Num	lber										
Category	DSE-VI A	Year	II	Credits	3	Cour	se	23MMA4E1			
		Semester	IV			Code					
Instruction	al Hours	Lecture	Т	utorial	Lab Practice			Total			
per week		4	4 1 5								
Pre-requisi	te	UG level N	UG level Numerical Analysis								
Objectives	of the	Aim of the	paper is	to develop	the knowle	edge tra	ansce	endental and			
Course		Polynomial	Equation	ons, System	of Linear A	Algebra	aic E	Equations and			
		Eigen Valu	Eigen Value Problems, Interpolation and Approximation,								
		Differentiat	tion and	Integration	and Ordina	ary Dif	ferei	ntial Equations.			
Unit – I:		Transcend	ental a	nd Polynon	nial Equati	ons:					
		Iterationme	thodsba	isedonsecon	Iddegreeequ	uation-	-				
		Rateofconv	ergence	-Iterationm	nethods– M	ethods	forc	omplexroots-			
		Polynomial	equation	ons.							
TT •4 TT		Chapter2:	Section	is 2.4 to 2.8	<b>-</b> (•	1.5.		X7 1			
Unit – 11:		System of	Linear	Algebraic I	Equations	and Ei	gen	Value			
		Problems :	ada Tui	an an lariaati	on Chalad	a na dD	antiti	anne ath a da			
		Directmeth	ous-1ri	angularisau	on, Cholesk	yandPa	aruu	Cincentrations			
		Erroranarysis-iteration methods – Eigen values and Eigenvectors –									
		method	Jacobi s method, Given s method, Kutisnaugnermethodand Power								
		Chanter3.	Section	s 3 7 to 3 5							
Unit III :		Internolati	on and	Annroxim	ation Hern	niteInte	rnol	ations_			
		Piecewisea	ndSplin	eInterpolati	on-Bivaria	teinter	oolat	tion-			
		Approxima	tion–L	east Square	approximat	ion–U	nifo	rm			
		approximat	ion.	1	11						
		Chapter4:	Section	ns 4.5 to 4.1	0						
Unit IV:		Differentia	tion an	d Integrati	on:Numeri	calDiff	feren	tiation-			
		PartialDiffe	erentiati	on–							
		NumericalI	ntegrati	onmethodsl	basedonund	letermi	ned	coefficients -			
		Double inte	gration	•							
		Chapter5:	Section	s 5.2,5.5, 5.	6, 5.8, 5.11						
Unit V:		Ordinary l	Differer	ntial Equat	ions: Num	ericaln	netho	ods–			
		Singlestepn	nethods	-Multistepr	nethods-Pr	edictor	∵–Co	rrectormethods.			
		Chapter 6:	Section	ns 6.2 to 6.4	5						
Extended	Professional	Questions	related	to the abo	ve topics,	from	vario	ous competitive			
Component	(is a part of	examination	ns UPS	C / TRB / N	NET / UGC	-CSI	R / (	GATE / TNPSC			
Internal	component	/ others to t	be solve	d T	. • 11	、 、					
only, Not to	be included	(To be disc	ussed di	uring the Ti	itorial hour	)					
In the	External										
Examination	question										
Skills acqui	red from this	Knowledge	- Droh	Jem Salvi	ng Analy	tical o	hilit	v Professional			
SKIIIS acqui	ieu mom uns	Competence	v, Profe	sectional Cor	ng, Analy	n and T	UIIII Frank	y, rioressional			
course		Competenc	y, profe	ssional Cor	mnumcauo	n and	ran	sterrable Skill			

<b>Recommended Text</b>	M.K.Jain,S.R.K.IyengarandR.K.Jain,NumericalMethodsForScientifi
	candEngineeringComputation, 3rdEdition,New age
	International,1993.
<b>Reference Books</b>	1.S.D.CorteanddeBoor,ElementaryNumericalAnalysis-
	AnAlgorithmicapproach,3 <sup>rd</sup> Edition,
	McGrawHillInternationalBookCompany, 1980.
	JamesB.Scarboraugh, Numerical Mathematical Analysis, Oxford&IB
	HPublishingCompany, New Delhi
	3 F B Hildebrand IntroductionToNumericalAnalysis
	McGrawHill NewYork 1956
Website and	1. https://www.math.upenn.edu/~wilf/DeturckWilf.
e-Learning Source	
_	2.https://web.archive.org/web/20120225082123
	3. /http://kr.cs.ait.ac.th/~radok/math/mat7/stepsa.htm

**Course Learning Outcome (for Mapping with POs and PSOs)** Students will be able to

**CLO 1:** understand the Iterationmethodsbasedonseconddegreeequation, Rateof convergence and Polynomial equations.

**CLO2:** define the direct methods, Triangularisation, Cholesky and Partition methods, Eigen values and Eigen vectors, Jacobi''s method and Given''s method.

. **CLO 3:** study the Hermite Interpolations,Piecewise and Spline Interpolation, Bivariate Interpolation, Approximation and Least Square and Uniform approximation.

**CLO 4:**learn the Numerical Differentiation, Partial Differentiation and Numerical Integration methods based on undetermined coefficients.

**CLO 5:**discuss the single step methods, Multi step methods and Predictor–Corrector methods.

			P	Os			PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	2	1	3	1	3	3	3	2	1
CLO2	3	1	2	2	3	3	3	2	1
CLO3	2	2	1	3	3	3	3	2	1
CLO4	1	2	2	1	3	3	3	2	1
CLO5	1	3	1	2	3	3	3	2	1

Title of the	Course			ALGEBR	AIC TOP	OLOGY	7				
Paper Nun	ıber										
Category	DSE-VI B	Year	II	Credits	3	Course	e 23MMA4E2				
		Semester	IV			Code					
Instruction	al Hours	Lecture	Т	utorial	Lab Prac	tice	Total				
per week		4		1			5				
Pre-requisi	ite	UG level A	UG level Algebra and Analysis								
Objectives	of the	The aim of	this cou	urse is to de	velop the ki	nowledg	e in algebraic				
Course		topology of	Homo	topy of path	s, Fundame	ental Gro	oup, Fundamental				
		Group of th	e circle	, Deformati	on Retracts	,Homoto	opy Type, Direct				
		sums of Abelian Groups, Free Groups, The Fundamental Group									
		wedge of ci	rcles, H	Iomology of	f surfaces,c	onstruct	ing				
		compactsur	faces, t	he Universa	l covering s	space an	d covering				
		transformat	ions.								
UNIT-I		Homotopy of	of paths	s - Fundame	ntal Group	- Cover	ring space - The				
		Fundamenta	al Grou	p of the circ	ele – Retrac	tions and	d Fixed points				
		Chapter 9:	Sectio	ns 51 to 55							
UNIT-II:		The Fundan	nental [	Theorem of	Algebra – I	Borsuk–	Ulam Theorem –				
		Deformation	n Retra	cts and Hon	notopy Typ	e – The	Fundamental Group				
		of S <sub>n</sub> - Fund	lamenta	al Groups of	some surfa	aces.					
		Chapter 9 :	: Sectio	ons 56 to 60							
UNIT-III		Direct sums of Abelian Groups – Free products of Groups – Free									
		Groups – Tl	he Seifert–van Kampen Theorem – The Fundamental								
		Group of a	wedge	of circles.							
		Chapter 11	: Sect	ions 67 to 7	71						
UNIT-IV :		Fundamenta	al group	os of surface	es – Homol	ogy of s	urfaces – cutting and				
		pasting – Tl	ne class	sification the	eorem – cor	nstructin	g compact surfaces.				
		Chapter 12	: Sect	ions 74 – 78	8						
UNIT-V:		Equivalence	e of cov	vering space	s – The Un	iversal c	overing space –				
		covering tra	nsform	ations – Ex	istence of c	overing	spaces				
		Chapter 1.	3 : Sect	tions 79 to 8	32						
Extended	Professional	Questions	related	to the ab	ove topics,	, from	various competitive				
Component	(is a part of	examination	ns UPS	C / TRB / N	VET / UGC	-CSIR	A / GATE / TNPSC /				
internal	component	others to be	solved								
only, Not to	be included	(To be discu	ussed d	uring the Tu	itorial hour	)					
in the	External										
Examination	n question										
paper)											
Skills acqui	red from this	Knowledge	e, Prol	blem Solv	ing, Analy	ytical a	bility, Professional				
course		Competency	y, Profe	essional Cor	nmunicatio	n and Ti	ransferrable Skill				
Recommen	ded Text	J.R.Munkre	s, Topo	ology, Pears	on Educatio	on Asia ,	, Second Edition				
		2002.									

<b>Reference Books</b>	1. M.K.Agoston, Algebraic topology – A First Course, Marcel
	Dekker, 1962.
	2. Satya Deo, Algebraic Topology, Hindustan Book Agency, New
	Delhi, 2003.
	3. M.Greenberg and Harper, Algebraic Topology – A First course,
	Benjamin/Cummings, 1981.
Website and	https://pi.math.cornell.edu/~hatcher/AT/AT
e-Learning Source	https://www.maths.ed.ac.uk/~v1ranick/papers/diecktop

**Course Learning Outcome (for Mapping with POs and PSOs)** 

Students will be able to

CLO 1: understand the quotient topology and their the identification works.

CLO 2: discuss on the concept of homotopy and homotopy equivalence of topological spaces.

CLO 3: compute the fundamental groups of standard topological spaces

**CLO 4** :learn thoroughly covering homotopy theorem.

CLO 5:appreciate and deduce the important Brouwer's fixed point theorem.

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	1	2	3	2	3	3	3	2	1		
CLO2	2	3	2	1	3	3	3	2	1		
CLO3	2	2	3	2	3	3	3	2	1		
CLO4	2	3	2	2	3	3	3	2	1		
CLO5	1	2	3	2	3	3	3	2	1		

Title of the	Course		]	FINANCIA	L MATHE	<b>EMATICS</b>	8			
Paper Num	ber									
Category	Elective	Year	II	Credits	3	Course	23MMA4E3			
		Semester	IV			Code				
Instruction	al Hours	Lecture	Т	utorial	Lab Prac	tice	Total			
per week		4		1			5			
Pre-requisi	te	UG level N	UG level Mathematics							
Objectives	of the	In this cour	se, the s	students are	on posed to	the basic	c concepts of			
Course		Probability	robability theory, The Central limit theorem. The concepts of							
		Geometric	Browni	an motion,	Option pric	ing. The d	erivatives of			
		Blackschol	e formu	la and its ap	oplications.	The conc	cept of call option			
		on Dividen	d payin	g securities,	estimating	the volati	lity parameter.			
		The limitat	ions of	Arbitrage pr	ricing, the p	ortfolio s	election problem.			
UNIT-I		Stochastic	Order	<b>Relations:</b>	First-Order	Stochasti	c Dominance -			
		Using Coup	oling to	Show Stock	hastic Domi	nance - L	ikelihood Ratio			
		Ordering -A	A Single	e-Period Inv	estment Pro	oblem-Sec	cond-Order			
		Dominance	-							
		Chapter 10	) : Sect	ions 10.1 t	o 10.5					
UNIT-II:		<b>Optimization Models:</b> Introduction- A Deterministic Optimization								
		Model -Pro	babilist	ic Optimiza	tion Proble	ms				
		Chapter 11	l:Sect	ions 11.1 t	o 11.3					
UNIT-III		Stochastic Dynamic Programming: The Stochastic Dynamic								
		Programmi	ng Prob	olem - Infini	te Time Mo	odels - Op	timal Stopping			
		Problems.								
		Chapter 12	2 : Sect	ions 12.1 to	o 12.3					
UNIT-IV :		Exotic Opt	ions: li	ntroduction	-Barrier Op	tions - As	and Lookback			
		Options - M	Ionte C	arlo Simula	tion -Pricin	g Exotic (	Options by			
		Simulation	- More	Efficient Si	mulation E	stimators.				
		Chapter 13	<u> 3 : Sect</u>	<u>ions 13.1 t</u>	<u>o 13.6</u>					
UNIT-V:		Beyond Ge	ometri	c Browniai	n Motion N	Iodels: In	troduction -Crude			
		Oil Data - M	Viodels	for the Cruc	le Oil Data	- Final Co	omments.			
<b>F</b> ( 1 1		Chapter 14		1000000000000000000000000000000000000	0 14.4	C	• • • • • •			
Extended	Professional	Questions	related	to the ab $C / TDD / D$	ove topics,	Irom Va	arious competitive			
Component	(is a part of	examination	ns UPS		NET / UGC	-CSIR/	GATE / INPSC /			
internal	component	others to be	solved			\ \				
only, Not u	De included	(10 be disc	ussea a	uring the T	liorial nour	)				
In the	External									
	n question									
paper)	rad from this	Vnowlada	$\mathbf{D}_{me}^{1}$	alom Col-	ing Angl-	rtigal at-	ility Drofossion-1			
Skills acqui	red from this	Competence	t, Prof	orgional Car	mg, Analy	n and Tra	nuy, Protessional			
Decommon	dod Toyt	Shaldan M	y, rrole	An Element	innunicatio	n and 1 fa	Institution SKIII			
Recommen	ueu rext	Finance 2:	A E 4:4: -		ai y Introdu		amematical			
		г nance,2n	1 Ea1110	n Cambridg	ge Universit	y press 20	JU J			

<b>Reference Books</b>	1. S.M.Ross, A First Course in Probability, Englewood cliffs N J
	Prentice Hall, 2002.
	2. J.Cox, M.Rubinstein, Option Market, Englewood cliffsNJ, Prentice
	Hall,1985.
	3. J.E.Ingersoll, Theory of Financial decision Making ,MD Rowerman
	of Little Fields, 1987.
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
e-Learning Source	http://www.opensource.org, www.mathpages.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** understand the first-Order Stochastic Dominance, a Single-Period Investment Problem and second-Order Dominance.

CLO 2: study Deterministic Optimization Model and Probabilistic Optimization Problems.

**CLO 3:** learnthe Stochastic Dynamic Programming Problem, Infinite Time Models and Optimal Stopping Problems.

CLO 4: discuss on Barrier Options with Simulation.

CLO 5 : study the Crude Oil Data and Models.

		POs							PSOs		
	1	2	3	4	5	6	1	2	3		
CLO1	3	2	1	3	3	3	3	2	1		
CLO2	2	3	3	2	3	3	3	2	1		
CLO3	1	3	2	1	3	3	3	2	1		
CLO4	2	1	2	3	3	3	3	2	1		
CLO5	3	2	3	2	3	3	3	2	1		

## SKILL ENHANCEMENT COURSE: (Internal Paper)

Title of the Course		MATHEMATICAL ECONOMICS								
Paper Numb	ber									
Category	SEC	Year	II	Credits	2	Course 23MMA		23MMA4SP		
		Semester	IV			Code				
Instructional Hours		Lecture	Т	utorial	Lab Practice		Total			
per week		3		-	4					
Pre-requisite	e	UG level N	lathem	atics		•				
Objectives	of the	The aim of	this cou	urse is to stu	dythe know	vledge	in M	Iathematical		
Course		concepts in Economics								
UNIT- I		Introduction to Mathematical Economics								
		(Chapters :	1)							
UNIT-II:		An introduction to Mathematical Economic Applications								
		(Chapter : 2)								
UNIT-III		Applications of Matrix Theory to Linear Models								
		(Chapter : 4)								
UNIT-IV :		Multivariate Calculus: Theory								
		(Chapter: 5	)							
UNIT – V		Multivariat	e Calcu	lus: Applica	ntions					
		(Chapter : 6)								
	ad frame this	Mathematical emploations by employed								
Skills acquire	ed from this	Iviathematical applications knowledge								
course		Mathematical Economics, Leffred Dallari, Lenar Des 16, 11, 1D, 1, (								
Recommended Text		Watnematical Economics, Jeffrey Baldani, James Bradfieldand Robert								
		W. Turner, The Dryden Press Harcourt Brace College Publishers,								
		1996.								
Website and		http://mirrors.ctan.org/info/lshort/english/lshort.pdf								
e-Learning Source		https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf								

**Course Learning Outcome (for Mapping with POs and PSOs)** 

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

CLO 1: Understand basic concepts of economics concepts in Mathematics

- CLO 2: knowing the applications of Mathematical Economics
- CLO 3: understand the applications of Matrix Theory to Linear Models
- **CLO 4**:understand the multivariate calculus concepts
- CLO 5 : study the multivariate calculus applications

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	1	2	3	2	3	3	3	2	1
CLO2	2	2	3	2	3	3	3	2	1
CLO3	2	2	3	3	3	3	3	2	1
CLO4	1	3	3	3	3	3	3	2	1
CLO5	1	2	3	2	3	3	3	2	1

Note: Internal Examination only

ABILITY ENHANCEMENT COURSE:(Internal Paper)											
Title of the	Course	SUB	BJEC	<b>FIVE SKII</b>	LLS IN MA	ATHEM	ATI	CS – II			
Category	AECC-	Year	II	Credits	2	Course		23MMA4AP			
	III	Semester	IV			Code					
Instructional Hours		Lecture	T	utorial	Lab Pra	ctice		Total			
per week		2		-			2				
Pre-requisi	ite	Basic Mathematics									
Objectives	of the	To update the skills of Complex analysis, Statistics - I & II, Graph Theory and									
Course		Operations Research	1.	-	•			- ·			
UNIT-I		COMPLEX ANAL	YSIS								
		Functions of a Complex variable - Continuous functions - Differentiability - The									
		Cauchy – Riemann	equat	ions – Anal	ytic function	ons – Ha	rmor	nic functions – Bilinear			
		Transformations –	Cross	s ratio – H	Fixed poin	ts-Comp	lex	integration - Definite			
		integral – Cauchy's Theorem – Cauchy's Integral formula – Higher derivatives -									
		Zeros of an analytic	Zeros of an analytic function Singularities-Residues – Cauchy's Residue Theorem.								
UNIT-II:		STATISTICS – I									
		Central Tendencies - Arithmetic Mean -Mode - Geometric Mean and Harmonic									
		Mean – Measures of Dispersion - Moments – Skewness and Kurtosis - Correlation –									
		Rank correlation Regression – Analysis of Time series – Time series – Components									
		of a Time series – Measurement of Trends - Probability – Conditional Probability –									
		Random variables - Discrete Random Variable - Continuous Random Variable -									
		Mathematical Expectations – Moment Generating Function – Characteristic									
		tunction.									
UNIT-III :		STATISTICS – II									
		Binomial Distribution – Poisson Distribution – Normal Distribution – Gamma									
		Distribution - Sampling - Tests of Significance for large samples- Tests of									
		Significance based on 't' Distribution – F-Test – Test for Significance of an									
		Observed sample correlation - Test based on Chi - Square Distribution – Chi									
		- Square Test for Population variance – Chi - Square Test – To test the Goodness									
		of fit – Test for Independence of Attributes – Analysis of Variance – One Criterion									
		of Classification – Two Criteria of Classification – Three criteria of Classification –									
		Latin Square.									
UNIT-IV :		GRAPH THEORY	:	1 -		<b>.</b> .					
		Graphs – Degrees – Sub graphs – Isomorphism – Independent Sets and Coverings –									
		Matrices – Dergee	Seque	ences – Gra	aphic sequ	ences –	Wall	ks, Trials and Paths $-$			
		Connectedness and	Com	ponents –	Blocks –	Connect	ivey	– Eulerian Graphs –			
		Hamiltonian Graphs	s - Ti	rees – Cent	re of a Ti	ree – M	atchi	ngs-Planer graphs and			
		properties – Chromatic number.									

	UNIT-V:									
	OPERATIONS RESEARCH									
	Origin and Development of O.R – Linear Programming problem – Mathematical									
	formulation of the problem –Graphical solution method – Canonical and Standard									
	forms of L.P.P – Simplex method - Artificial variables (Big M method – Two Phase									
	method) Duality in linear programming – General primal and dual pair –									
	Formulating a Dual problem – Primal – Dual pair in matrix form – Duality and									
	Simplex method – Dual simplex method -Formulation of T.P. – Existence of									
	solution in T.P. – Assignment problem – Introduction – Mathematical									
	formulation of the problem – Test for optimality by using Hungarian method –									
	Maximization case in Assignment problem.									
Skills acquired from	Knowledge, Problem Solving, Analytical ability, Professional Competency,									
this course	Professional Communication and Transferrable Skill									
<b>Reference Books</b>	Under Graduate Books									
Website and	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,									
e-Learning Source	http://www.opensource.org, http://en.wikipedia.org									
Course Learning	Outcome (for Mapping with POs and PSOs)									
Students will be	able to									

Students will be able to

CLO 1: understand the concepts of Complex Analysis. CLO 2:learn the Statistical concepts CLO 3: solve the problems in Statistics CLO 4: update the concepts of Graph Theory.

CLO 5: solve the problems in Operations Research.

			PSOs						
	1	2	3	4	5	6	1	2	3
CLO1	3	1	2	3	3	3	3	2	1
CLO2	2	1	3	2	3	3	3	2	1
CLO3	2	3	1	3	3	3	3	2	1
CLO4	1	3	2	3	3	3	3	2	1
CLO5	3	2	3	1	3	3	3	2	1

**Note: Internal Examination only** 

Title of the Course		PROJECT WITH VIVA VOCE								
Paper Number		CORE IVX								
Category	Core	Year	II		Credits	3	Cou	rse 23MMA4PR		
		Semester	IV	r			Cod	e		
Instructional Hours		Lecture	cture Tutor		ial Lab Practi		tice	Total		
per week		4					4			
Pre-requisite		UG Level	Mathe	matic	s					

1.Question pattern for Skill Enhancement Course (SEC 1 & SEC 2): Maximum Marks: 100
<u>Part - A (10×2 = 20)</u> 10 questions
<u>Part - B (5×6 = 30)</u> Either (or) type 5 questions
<u>Part - C (5×10 = 50)</u> Open choice 5 out of 8 questions

## 2. <u>Question pattern for Ability Enhancement Course:</u> Maximum Marks = 100

100 Objective questions: 100×1=100

- 3. Internship report –Marks -Vivo-voce (25) + reports (50) + internal (25) = 100
- 4. Project Dissertation- Marks -Vivo-voce (50) + thesis (100) + internal (50) = 200