M.Sc., MATHEMATICS SYLLABUS 2023 ONWARDS

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN, PALANI.

(Autonomous)

(Re-accredited With B⁺⁺grade by NAAC in 3rd Cycle)



M.Sc., MATHEMATICS

TANSCHE SYLLABUS TO BE IMPLEMENTED FROM THE ACADEMIC YEAR 2023-2024 (CHOICE BASED CREDIT SYSTEM)

M.SC MATHEMATICS SYLLABUS 2023 ONWARDS

PG DEPARTMENT OF MATHEMATICS M.SC. MATHEMATICS SYLLABUS 2023-2024 ONWARDS



ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN (Affiliated to Mother Teresa Women's University, Kodaikanal) Nationally Reaccredited with B⁺⁺ Grade by NAACin 3rd Cycle Chinnakalayamputhur, Palani - 624 615.

Department of Mathematics- Outcome Based Education Syllabus 2023-2024 onwards

M.SC MATHEMATICS SYLLABUS 2023 ONWARDS

PG DEPARTMENT OF MATHEMATICS

Choice Based Credit System (CBCS)

(2023-2024 onwards)

M.SC. MATHEMATICS

Preamble:

The main aim of the Programme is intended to provide in-depth knowledge to the students in advanced Pure and Applied mathematics and prepare them for various research activities and career opportunities. The Programme is designed to impart proficiency in Mathematical application in day-to-day in simple and complex situations. The Programme also will enable the learners to shine as collaborators and innovators in addressing social, technical, and business challenges. Programme through its wide range of Courses trains the students as competent citizens with advanced mathematical knowledge and ethically sound humans with its insistence of human ethics. The Programme is intended to promote the culture of interdisciplinary studies and research that is much needed for the current scenario.

Program Educational Objectives (PEOs)				
The M. S	The M. Sc. Mathematics program describe accomplishments that graduates are expected to			
attain wit	hin five to seven years after graduation			
	Provide a strong foundation in different areas of Mathematics, so that the students			
PEO1	can compete with their contemporaries and excel in the various careers in			
	Mathematics.			
DEO2	Motivate and prepare the students to pursue higher studies and research, thus			
FEO2	contributing to the ever-increasing academic demands of the country.			
	Enrich the students with strong communication and interpersonal skills, broad			
PEO3	knowledge and an understanding of multicultural and global perspectives, to work			
	effectively in multidisciplinary teams, both as leaders and team members.			
	Facilitate integral development of the personality of the student to deal with ethical			
PEO4	and professional issues, and also to develop ability for independent and lifelong			
	learning.			
PEO5	improvise the women resource that is furnished with the mathematical skills that			
	are necessary in the altering industrial and socio-economic development of			
	the,country			

M.SC MATHEMATICS SYLLABUS 2023 ONWARDS

Program Specific Outcomes (PSOs)			
After the su	accessful completion of M. Sc. Mathematics program, the students are expected to		
PSO1	Communicate concepts of Mathematics and its applications.		
PSO2 Acquire analytical and logical thinking through various mathematical tools and techniques			
PSO3 Investigate real life problems and learn to solve them through formulating mathematical models.			
PSO4	Attain in-depth knowledge to pursue higher studies and ability to conduct research. Work as mathematical professional		
PSO5	Achieve targets of successfully clearing various examinations/interviews for placements in teaching, banks, industries and various other organizations/services.		

Program (Program Outcomes (POs)			
On success	On successful completion of the M. Sc. Mathematics program, the students will be able to			
PO1	Demonstrate in-depth knowledge of Mathematics, both in theory and application.			
PO2	Attain the ability to identify, formulate and solve challenging problems in Mathematics.			
PO3	Know the various specialised areas of advanced mathematics and its applications.			
PO4	Analyze complex problems in Mathematics and propose solutions using research- based knowledge.			
PO5	Obtain the accurate solutions for the community oriented problems via various mathematical models.			
PO6	Work individually or as a team member or leader in uniform and multidisciplinary settings.			
PO7	Crack lectureship and fellowship exams affirmed by UGC like CSIR-NET and SET.			
PO8	Apply the Mathematical concepts, in all the fields of learning including higher research, and recognize the need and prepare for lifelong learning.			
PO9	Know the use of computers both as an aid and as a tool to study problems in Mathematics.			
PO10	Inculcate the knowledge of formulation and apply the mathematical concepts which are suitable for real life applications.			

1. Eligibility : B.Sc. Mathematics

2. General Guidelines for PG Programme

- i. **Duration:** The programme shall extend through a period of 4 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.
- ii. Medium of Instruction: English
- iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment and External Examination.
 - Evaluation Pattern

Evaluation	Theory&	Practical
Pattern	Min	Max
Internal	13	25
External	38	75

- Internal (Theory): Test (15) + Assignment (5) + Seminar/Quiz(5) =25
- External Theory:75

Components of Continuous Internal Assessment

Compor	nents	Marks	Total
	Т	heory	
CIA I	30	(30+30=60/4)	
CIA II 30		15	25
Assignment		5	
Seminar/Q	uiz	5	

• Question Paper Pattern for Internal examination for all core and Elective papers.

Max.Marks:25		Time: 2Hrs.	
S.No.	Part	Туре	Marks
1	Α	3*2 Marks=6 Q.No.1 to 3	6
2	B	2*4 Marks=8 (Either or Pattern) Q.No. 4 and 5	8
3	C	2*8 Marks=16 (Either or Pattern) Q.No. 6 and 7	16
		Total Marks	30

• Question Paper Pattern for External examination for all course papers.(except Elective-VI Mathematical Python -Theory and Practical)

Max.Marks:75 Time: 3		Hrs.	
S.No.	Part	Туре	Marks
1	Α	10*2 Marks=20	20
		Two questions from each Unit, Each question carries two marks	
2	В	5*5=25	25
		Two questions from each Unit with Internal Choice (either / or)	
3	C	3*10=30 Open Choice: Any three questions out of 5 : One question from each unit	30
		Total Marks	75

• External Question pattern Elective-VI - Mathematical Python - Theory

Max.Marks:50 Time: 31		Hrs.	
S.No.	Part	Туре	Marks
1	Α	5*1 Marks=5	5
		One questions from each Unit	
2	В	5*3=15	15
		Two questions from each Unit with Internal Choice (either / or)	
3	С	3*10=30	30
		Open Choice: Any three questions out of 5 : One question from	
		each unit	
		Total Marks	50

Practical				
Record	10			
Programme and Output	10	25		
Viva	5			

• External Question pattern Elective-VI - Mathematical Python–Practical

• Question Paper Pattern for Internal examination for Skill Enhancement Course-NME-I: OFFICE AUTOMATION AND ICT TOOLS (PRACTICAL)

Max.Marks:25		Time: 2Hrs.	
S.No.	Part	Туре	Marks
1	Α	3*1 Marks=3 Q.No.1 to 3	3
2	B	2*3 Marks=6 (Either or Pattern) Q.No. 4 and 5	6
3	C	2*8 Marks=16 (Either or Pattern) Q.No. 6 and 7	16
		Total Marks	25

• Question Paper Pattern for External examination for Skill Enhancement Course-NME-I: OFFICE AUTOMATION AND ICT TOOLS (PRACTICAL) Max.Marks:75

Practical				
Record	25			
Programme and Output	25	75		
Viva	25			

Question Paper Pattern for External examination for Skill Enhancement • **Course- NME-II:** Mathematical documentation using LATEX

Max.Marks:25		Time: 1Hrs.	
S.No.	Part	Туре	Marks
1	Α	3*1 Marks=3 Q.No.1 to 3	3
2	B	1*4 Marks=4 (Either or Pattern) Q.No. 4	4
3	С	1*8 Marks=8 (Either or Pattern) Q.No. 5	8
		Total Marks	15

Components of Continuous Assessment (Part IV)

	1		
Components		Calculation	CIA Total
CA1	15 Marks	$\frac{15+15}{1}=15$	
CA2	15 Marks	2	25 Martza
Assignment	5 Marks	5	
Seminar	5 Marks	5	

Question Paper Pattern for External examination for Skill Enhancement • **Course- NME-II and Professional Competency Skill Enhancement** Course –III

Max.Marks:75

Max.Marks:75 Time: 3E		Irs.	
S.No.	Part	Туре	Marks
1 A	Α	10*2 Marks=20	20
		Two questions from each Unit, Each question carries two marks	
2	В	5*5=25	25
		Two questions from each Unit with Internal Choice (either / or)	
3	С	3*10=30 Open Choice: Any three questions out of 5 : One question from each unit	30
		Total Marks	75

* Minimum credits required to pass: 91

• Project Report

A student should select a topic for the Project Work at the end of the third semester itself and submit the Project Report at the end of the fourth semester. The Project Report shall not exceed 75 typed pages in Times New Roman font with 1.5 lines space.

Project Evaluation

There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination.

PROJECT WORK

The ratio of marks for Internal and External Examination is 25:75

Components	Semester Examination
Review	15
Regularity	10
Total	25

THE INTERNAL COMPONENTS OF PROJECTS

Components	Marks
Project Report	50
External Viva Voce	25
Total	75

EXTERNAL VALUATION OF PROJECT WORK

INTERNSHIP / INDUSTRIAL TRAINING

Duration of the Training:

 The learners of all the Under-Graduation Programmes are to undergo the Internship / Industrial Training during the summer vacation(after completion of the Second Semester examinations) 30 hours.

Evaluation:

- * After completion of the training, the evaluation of the performance of the learners will be done in the III semester.
- * Two credits will be awarded for the best performers.

- * Viva-voce examination will be conducted and the learners have to appear for the Vivavoce individually.
- * At the time of Viva-voce, the learners have to submit the given records to the examiner.
 - Work Diary, endorsed by the trainer
 - A complete report on the objectives, modules and outcomes.

A certificate, duly signed and issued by the trainer

Range of	Grade Points	Letter Grade	Description
Marks			
90 - 100	9.0 - 10.0	0	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5 - 7.9	D	Distinction
70-74	7.0 - 7.4	A+	Very Good
60-69	6.0 - 6.9	А	Good
50-59	5.0 - 5.9	В	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

3. Conversion of Marks to Grade Points and Letter Grade (Performance in a Course/Paper)

4. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the Prescribed Form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the Prescribed Form with the prescribed fee along with the Medical Certificate. Students with attendance lesser than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

5. Any Other Information

In addition to the abovementioned regulations, any other common regulations pertaining to the PG Programmes are also applicable for this Programme.

PG DEPARTMENT OF MATHEMATICS M.Sc. Mathematics (For the students admitted during the academic year 2023 – 2024 onwards)

S.NO	Course	Title of the Course	urse Credits Hour		Ma	Aarks		
	Code	The of the course	Creans	Theory	Practi cal	CIA	ESE	Total
		FIRST S	EMEST	ER	1			1
1		CC1 - Algebraic Structures	5	7	—	25	75	100
2		CC2 - Real Analysis I	5	7	_	25	75	100
3		CC3-Ordinary Differential Equations	4	6	_	25	75	100
4		Elective I(Generic / Discipline Specific) Graph Theory and Applications / Numerical Methods	3	5(4L+ 1T)	_	25	75	100
5		Elective II(Generic / Discipline Specific) Fuzzy Sets and their Applications /Mathematical Programming	3	5(4L + 1T)	_	25	75	100
		Total	20	30		125	375	500
		SECOND	SEMES'	TER				
6		CC4 – Advanced Algebra	5	6	-	25	75	100
7		CC5 – Real Analysis II	5	6	-	25	75	100
8		CC6 - Partial Differential Equations	4	6	_	25	75	100
9		Elective III(Generic / Discipline Specific) Mathematical Statistics/Statistical Data Analysis using R Programming	3	4	_	25	75	100
10		Elective-IV(Computer / IT related) Modeling and Simulation / Neural Networks	3	4	_	25	75	100
11		Skill Enhancement Course (SEC)- I: Non-Major Elective: Office Automation and ICT Tools- Practical	2	-	4	25	75	100
		Total	22	26	4	150	450	600

	THIRD	SEMES	STER				
12	CC7 - Complex Analysis	5	6	_	25	75	100
13	CC8 - Probability Theory	5	6		25	75	100
14	CC9 – Topology	5	6	_	25	75	100
15	CC10 - Mechanics		6	—	25	75	100
16	5 Elective V(Generic / Discipline Specific) Fluid Dynamics/ Stochastic Process		3	-	25	75	100
17	Skill Enhancement Course (SEC)- II: Non-Major Elective: Mathematical documentation using LATEX	2	3	-	25	75	100
18	Internship / Industrial Activity (Carried out in Summer Vacation at the end of I year – 30 hours)	2		-	100	-	100
	Total	26	30	-	250	450	700
	FOURTH	I SEME	ESTER				
19	CC11–Functional Analysis	5	6	—	25	75	100
20	CC12 - Differential Geometry	5	6	-	25	75	100
21	CC13 - Project with viva voce	7	10	—	25	75	100
22	Elective VI(Generic / Discipline Specific) Mathematical Python -Theory and Practical / Financial Mathematics	3	2	2	25	75	100
23	Professional Competency Skill Enhancement Course –III: Training for Competitive Examinations • Mathematics for NET / UGC - CSIR/ SET / TRB Competitive Examinations (2 hours) • General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours)	2	4	-	25	75	100
24	Extension Activity	1	-	-	100	-	100
	Total	23	28	2	225	375	600
	Grand Total	91	114	6	750	1650	2400

Note:

- CIA Continuous Internal Assessment
- ESE End of Semester Examinations

Course	code		Core Paj	per I:	ALGE	EBRAIC	C STRU	CTURES		L	Т	P	С
Semeste	er-I									7	0	0	5
Course	Objectiv	ves:										1	
The main	n objecti	ves of this c	ourse are to	:									
1. To 2. To equ	provide c introduce ations by	deep knowle e Galois The v radicals.	edge about velocity and to s	various see its	algebr applica	raic stru ation to	the sol	vability o	of polyr	nomia	al		
Expecte	d Cours	e Outcome	S:										
On the	successfi	ul completio	on of the cou	urse, st	tudent	will be	able to:						
1	Underst	tand Sylows	s theorem an	nd its a	pplicat	tions						K	3
2	Formul	ate some sp	ecial types of	of ring	s and the	heir pro	perties.					K	6
3	Acquire	e knowledge	e on extensio	on field	ds and	roots o	f polyn	omials				K	4
4	Analyz	e the eleme	nts of Galois	s theor	y and (Galois (Groups	over the	rational	ls		K	4
5	Underst	tand the bas	ic concepts	of solv	vability	y by rad	licals ar	d finite f	fields.			K	2
K1 - Re	emember	; K2 - Und	erstand; K3	- Appl	ly; K4	- Analy	ze; K5	- Evalua	te; K6	- Cre	ate		
			-										
IInit.1											01	1	
Anothe	er Counti	ng Principle	Svlow's T	Gro beorer	up Th	eory 2nd and	d 3rd na	rts of Sv	low's T	heor	21 rems	nou – do	rs uble
Anothe coset –	er Countin the norm	ng Principle nalizer of a	s, Sylow's T	Gro heoren	n: 1st,	eory 2nd and	d 3rd pa	rts of Sy	low's T	Theor	21 rems	nou – do	rs uble
Anothe coset – Unit:2	er Countin the norm	ng Principle nalizer of a	e, Sylow's T group. Group The	Gro heoren	oup Th n: 1st, contd) :	and Ri	d 3rd pa ng The	ory	low's T	Theor	21 rems 21 21	hou - do hou	rs uble rs
Anothe coset – Unit:2 Direct I Rings, 1	er Countin the norm Products: Polynom	ng Principle nalizer of a : External an ial rings.	, Sylow's T group. Group The nd Internal d	Gro heoren eory (c lirect F	n: 1st, contd) : Product	eory 2nd and and Ri ts, Eucl	d 3rd pa ng The lidean R	ory ings, A l	low's T	Theor	21 rems 21 21 iclide	nou – do hou ean	rs uble rs
Anothe coset – Unit:2 Direct I Rings, J	er Countin the norm Products: Polynom	ng Principle nalizer of a External an ial rings.	e, Sylow's Ti group. Group The nd Internal d	Gro heoren eory (c lirect F	n: 1st, contd) : Product	eory 2nd and and Ri ts, Eucl	d 3rd pa ng The lidean R	orts of Sy ory ings, A l	low's T	Theor	21 rems 21 21 aclide	nou – do hou ean	rs uble rs
Anothe coset – Unit:2 Direct I Rings, J Unit:3	er Countin the norm Products: Polynom	ng Principle halizer of a : External an ial rings.	s, Sylow's T group. Group The nd Internal d Ring The	Gro heoren eory (c lirect F eory (c	n: 1st, contd) : Product	and Ri and Ri ts, Eucl	d 3rd pa ng The lidean R ields	orts of Sy ory ings, A l	low's T	Theor	21 rems 21 aclide 21	hou ean	rs uble rs rs
Anothe coset – Unit:2 Direct I Rings, I Unit:3 Polyno	er Countin the norm Products: Polynom omials ov	ng Principle nalizer of a External an ial rings.	, Sylow's T group. Group The nd Internal d Ring The fields – exter	Gro heoren eory (c lirect F eory (c nsion f	n: 1st, contd) = Product contd) fields -	and Ri and Ri ts, Eucl and Fi - roots o	d 3rd pa ng The lidean R ields of polyr	ory ings, A l	low's T Particul	Theor ar Eu	21 rems 21 aclide 21 elds.	hou hou hou	rs uble rs rs
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Te	ext Book(s)		
1	I.N. Herstein, Topi	ics in Algebra, Secnd Edition, John Wiley and Sons, New York, 1975	5.
	UNIT I:	Chapter2 : Sections 2.11,2.12	
	UNIT II:	Chapter2 : Section2.13	
		Chapter3 : Sections 3.7-3.9	
	UNIT III:	Chapter3 : Section3.10	
		Chapter 5 : Sections 5.1,5.3	
	UNIT IV:	Chapter 5 : Sections 5.5,5.6	
	UNIT V:	Chapter 5 : Section 5.7	
		Chapter7 : Section7.1	

Reference Books

1	Serge Lang, Algebra, Third Edition, Addison-Wesley, Mass, 1993.
2	John B. Fraleigh, A First Course in Abstract Algebra, Addison Wesley, Mass, 1982.
3	M. Artin, Algebra, Prentice-Hall of India, New Delhi, 1991.
4	V. K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt
	Limited, 1993.

Mappir	ng with Progr	amme (Outcome	es							
COs	POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	Р
CO1		Μ	L	L	L	Μ	S	L	S	Μ	Μ
CO2		S	S	Μ	L	L	S	L	S	Μ	S
CO3		Μ	L	S	Μ	S	Μ	Μ	L	L	S
CO4		Μ	L	S	S	S	Μ	Μ	L	L	S
CO5		L	Μ	Μ	S	Μ	L	S	Μ	S	Μ

Course co	de	Core Paper II: REAL ANALYSIS-I	L	Т	P	C
Semester-	[7	0	0	5
Course Of	iectives:					
The main o	bjectives of the	is course are to:				
	1. To convey	concepts of real valued functions in detail.				
	2. To provide	the deep knowledge about sequences and series.				
	3. To make a	clear difference between differentiability and continuity				
	4. To know so	ome basic theorems.				
On the su	Course Outcon	mes: etion of the course, student will be able to:				
	Apply the Rie	enon of the course, student will be able to.				K3
1	rectifiable cu	rves.				IX.J
2	Remembering	g of sequences and series along with its properties				K 1
3	Analyze the c	concept of linear transformation and find the extreme values nctions.	3			K4
4	Understand th	ne fundamental concept of Lebesgue measure.				K2
5	Evaluate the	complex integration and the benefits of Lebesgue Integral				K5
K1 - Rem	ember; K2 - U	nderstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 -	Crea	ate	•	
∐nit•1		Countable and Uncountable sets		21	hor	irc
equiva examp -Com its pro	alence relation ples- Basic defi pact sets- defin pperties- k- cell	with theorems and examples- Metric spaces –Euclidean initions of metric spaces and its examples – Open and close nition of compact sets with union and intersection theorem is compact-Weierstrass theorem	spac ed se ns ai	es ets nd		
T T 1 / A			1			
Unit:2	luction about	Perfect sets	nd i	21 ts	hou	Irs
theore diverg and c examp The ro	em- Connected gence sequence omplete - Up ples– Series – 1 pot and ratio te	sets-real line is connected property theorem- Convergent is in a metric space theorems –Subsequences - Cauchy sequences and lower limits - Some special sequences theorem harmonic series and geometric series examples - The numbers and its examples	nt an uenco ns ar ber e	nd es nd e -		
TI		Power series		21	hou	rs
Unit:5	nition of Powe	r series – radius of convergence with problems - Summat	ion ł	by		

Unit:4	Continuity function	21 hours
Contir	nuity: Limits of functions - Continuous functions and their prope	erties and
theore	ms- continuity and compactness- uniform continuous-theorems -The	derivative
of a re	al function with properties and examples-Mean value theorems and ge	eneralized
Mean	value theorem- The continuity of derivatives - L"Hospital" rule	
Unit:5	The Riemann-Stieltjes Integral	21 hours
Introc	luction of Riemann-Stieltjes Integral: Definition and existence of the	integral –
definit	ion of refinement -upper and lower partition theorems-Propertie	es of the
Riema	nn-Stieltjes Integral and its theorems- definition of unit step	function-
Integra	ation and differentiation -fundamental theorem of calculus- integ	ration by
parts-	Integration of vector valued functions.	
	Total Lecture hours	105 hours
	· ·	
Text Bool	k(s)	
1	1. Walter Rudin "Principles of Mathematical Analysis" 3rd	
	Edition. McGraw –Hill International Book Company.	
	Singapore.(1982).	
	Units I: Chapter- 2: 2.1 to 2.42	
	Unit II: Chapter- 2: 2.43 to 2.47 and Chapter -3:3.1 to 3.37	,
	Unit III: Chapter- 3: 3.38 to 3.58	
	Unit IV: Chapter-4: 4.1 to 4.21 and Chapter -5: 5.1 to 5.13	
	Unit V: Chapter- 6:6.1 to 6.23	
Reference	e Books	
1 R	G Bartle Elements of Real Analysis 2nd Edition John Wilv and Sc	ons New York 1976
$\frac{1}{2}$ S	Kumaresan , "Topology of Metric Spaces", 2 nd Edition, Narosa Publ	ishing House, 2011
- 0		151111g 110 450, 2011
3 S	Ponnusamy "Foundations of Mathematical Analysis" Springer Birk	hauser 2012
	F Simmons "Introduction to Topology and Modern Analysis" Mac	ow Hill Now
4 G.	shi 2004	aw –IIII, INEW
	лп,200т.	
Dal-4 1 C	The Contents IMOOC STRATAN NUMBER AND STORES AND STRATES	
	https://www.voutube.com/watch?v=D00Dzz07DNI	
$\frac{1}{2}$	https://www.youtube.com/watch?v=DO0DZ20/DINI	
$\frac{2}{3}$	https://www.youtube.com/watch?v=Y5vFMXZnzVw	
4	https://voitu.be/msIZz8vdzcM	
•	<u>mupor journov mondo judom</u>	

Mapping with	Program	nme Ou	tcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	S	Μ	S	Μ	S	S	S	S
CO3	S	Μ	Μ	L	S	S	S	L	L	L
CO3	L	Μ	S	L	Μ	Μ	Μ	S	Μ	S
CO4	L	Μ	S	L	Μ	S	S	S	Μ	Μ
CO5	Μ	L	S	Μ	S	L	Μ	Μ	L	L

Course co	de	Core Paper III: ORDINARY DIFFERENTIAL EOUATIONS	L	Т	Р	C
Semester-	[6	0	0	4
Course O	jectives:		I			
The main o	bjectives	of this course are to:				
 Study Under and ut Enabl and in 	Solutions stand and niqueness es the stud terpreting	of Linear differential equations with constant and variable able to apply various theoretical ideas that underlined in ex- theorems, Linear independence and dependence, Wronskia lents to develop the strong background on modeling, formu- physical problems.	coeff kisten n etc. lating	icien ce , g, so	nts. lving	
Expected	Course O	utcomes				
On the su	ccessful c	ompletion of the course, student will be able to:				
1	Recall the equations	types of linear homogeneous equations of second order with constant coefficients and apply the method to solve.			K1	
2	Analyze n	on-homogeneous ODE using the method of undermined ts and annihilator method to solve the same.			K4	
3	Understan	d and Apply the theorems on Initial value problem to			K2,	
4	Ordinary c	inferential equations.			K3	
4	Comprene Singular r	points at infinity and to evaluate			КЭ	
5	Identify the model the	be research problem where differential equation can be used problem.	l to		K6	
K1 - Ren	ember; K	2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	K6 -	Crea	ate	
Unit:1		Linear Equations with Constant Coefficients		18	hour	5
Introductions -	n - Secon Linear de	d order homogenous equations - Initial value problem for s ependence and independence - A formula for Wronskian	econd	l ord	ler	
Unit:2	L	inear Equations with Constant Coefficients (Contd)		181	nours	
The Non- order n - Iı	nomogenc itial value	bus equations of order two-homogenous and Non - homogenous for n th order equations.	enous	equ	ation	S O
Unit:3		Linear Equations with Variable Coefficients		18 F	ours	
Initial va	ue probl	em - Existence and uniqueness theorem - The Wro	nskiaı	n ai	nd lin	near
independer equation -	ice - Red Homoger	luction of the order of a homogenous equation - The nous equations with analytic coefficients - The Legendre equations - The Lege	non- uation	Hon ns.	nogen	lous
Unit:4		Linear Equations with Regular Singular Points		18 h	ours	
The Euler	equations	- Second order equations with regular singular points - Exc	eptio	nal c	ases	-

Unit:5	Existence and Uniqueness of Solutions to First Order	18 hours
	Equations	

Equations with variable separated - Exact equations - The method of successive approximation - The Lipschitz Condition - Convergence of the successive approximation. Non- local existence of solution – Approximations and uniqueness of solutions

				Total Lecture hours	90 hours
Text]	Book(s)	·			
1	Earl A. Co	oddington, An Int	roduction to O	rdinary Differential Equations, 1	Prentice-Hall
	of India F	Private Limited, N	lew Delhi2008		
l		UNIT I:	Chapter2	: Sections 2.1 –2.5.	
l		UNIT II:	Chapter2	: Sections $2.6 - 2.8$, 2.10 .	
		UNIT III:	Chapter3	: Sections 3.1 – 3.8	
		UNIT IV:	Chapter4	: Sections $4.1 - 4.4$, $4.6 - 4.8$	3
		UNIT V:	Chapter5	: Sections 5.1 – 5.8	
Refer	ence Books	5			
1	Williams	E. Boyce and Ric	hard C. Diprin	na. Elementary Differential Equa	ations

1	Williams E. Boyce and Richard C. Diprima, Elementary Differential Equations
	and Boundary Value Problems, 10th edition, John Wiley and Sons, New York
2	S. G. Deo and V. Raghavendra, Ordinary Differential Equations and Stability
	Theory, Tata McGraw-Hill, New Delhi 1980.
3	George F. Simmons, Differential Equations with Application and Historical Notes,
	Tata McGraw Hill, New Delhi 1974.

Mapping with	h Progra	amme O	utcomes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	Μ	Μ	S	L	S	Μ	S	L
CO3	Μ	S	S	Μ	S	S	S	S	S	Μ
CO3	L	Μ	S	S	S	S	S	S	S	S
CO4	Μ	S	L	Μ	S	Μ	S	S	L	S
CO5	L	Μ	S	S	S	Μ	S	S	L	Μ

Course co	le		Elective -I: GRAPH THEORY AND APPLICATIONS	L	T	P	С
Semester-l	[4	1	0	
Course Of	iectiv	es:					
The main o	bjectiv	ves of th	is course are to:				
1. To	provid	e deep k	cnowledge about fundamental concepts of Graphs an	d Tree	s.		
2. To	introdu	ice Mate	chings, Coloring, and Chromatic Number and to see	its app	olicat	ion i	n
hig	gher or	der thin	king.				
F	<u>م</u>	04					
On the su	Course	l compl	mes: etion of the course, student will be able to:				
	Under	rstand th	he hasic concepts of Graphs and Trees			K	2
2	Analy	ze verte	e basic concepts of Oraphs and Trees			K	Δ
3	Acqui	ire know	yledge in Matching and Colourings			K	.т Д
<u> </u>	Apply	v Chrom	atic Number			K	3
5	Deter	mining 1	the planar non-planar and directed graphs			K	5
5 K1 - Rem	ember	$\cdot \mathbf{K}_{2} - \mathbf{I}$	Inderstand: K3 - Apply: K4 - Applyze: K5 - Evaluat	e' K6	– Cre	ate	
		, 112 C		•, 110		Juie	
Unit:1 Graphs, S Adjacency Trees: Tr	Subgra y matri ees – C	aphs: Gr ices, Sul Cut edge	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices	e Incic Cycles	1 lence	15 h and	ou l
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti	Subgra y matri ees – (vity: (aphs: Gr ices, Sul Cut edge Co Connecti	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti	e Incic Cycles	1 lence	15 h and	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou	Subgra y matri ees – (vity: (rs and	aphs: Gi ices, Sul Cut edge Co Connecti I Hamil	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles.	e Incic Cycles vity.	1 lence s. 1	15 h and	ou ou
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connectiv Euler tou	Subgra y matri ees – (vity: (rs and	aphs: G ices, Sul Cut edge Co Connecti I Hamil	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles.	e Incic Cycles vity.	1 lence	15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connectiv Euler tou Unit:3 Matching	Subgra y matri ees – (vity: (rs and s: Ma	aphs: Gr ices, Sul Cut edge Co Connecti I Hamil tchings of	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices onnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings.	e Incic Cycles vity.	1 lence	15 h and 15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connectiv Euler tou Unit:3 Matching Edge colo	Subgra y matri ees – (vity: (rs and s: Ma puring	aphs: Grand Strain Stra	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem.	e Incic Cycles vity.	1 lence	15 h and 15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou Unit:3 Matching Edge colo	Subgra y matri ees – C vity: C rs and ss: Ma puring	aphs: Gr ices, Sul Cut edge Co Connecti I Hamil tchings of s: Edge	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem.	e Incic Cycles vity.	1 lence :. 1	15 h and 15 h 15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connectiv Euler tou Unit:3 Matching Edge colo Unit:4 Independ	Subgra y matri ees – (vity: C rs and ys: Ma yuring ent se	aphs: Grand Strain Stra	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem. endent sets, Cliques and Vertex Colourings ues: Independent sets – Ramsey's theorem.	e Incic Cycles vity.	1 lence	15 h and 15 h 15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou Unit:3 Matching Edge colo Unit:4 Independ Vertex Co	Subgra y matri ees – C vity: C rs and s: Ma ouring ent se plouri	aphs: Gr ices, Sul Cut edge Connecti I Hamil tchings of s: Edge Indep ts, Cliqu ngs: Chi	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem. endent sets, Cliques and Vertex Colourings ues: Independent sets – Ramsey's theorem. romatic Number – Brook's Theorem – Chromatic po	e Incic Cycles vity.	1 lence 3. 1 1 1	15 h and 15 h 15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou Unit:3 Matching Edge colo Unit:4 Independ Vertex Co	Subgra y matri ees – (vity: C rs and y s: Ma yuring ent se plouri	aphs: Gr ices, Sul Cut edge Connecti I Hamil tchings of s: Edge Indep ts, Cliqu ngs: Ch	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem. endent sets, Cliques and Vertex Colourings ues: Independent sets – Ramsey's theorem. romatic Number – Brook's Theorem – Chromatic po	e Incic Cycles vity.	1 lence 3. 1 1 1 1 ial	15 h and 15 h 15 h	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou Unit:3 Matching Edge colo Unit:4 Independ Vertex Co Unit:5 Planar G	Subgra y matri ees – C vity: C rs and s: Ma ouring ent se olouri ent se	aphs: Gr ices, Sul Cut edge Connecti I Hamil tchings of s: Edge Indep ts, Cliqu ngs: Chi	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices mnectivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem. endent sets, Cliques and Vertex Colourings ues: Independent sets – Ramsey's theorem. romatic Number – Brook's Theorem – Chromatic po Planar Graphs and Directed Graphs and planar Graphs - Ks non-planar graph – Dual	e Incic Cycles vity.	1 lence 3. 1 1 1 1 1 1 1 1 3. – F	$\frac{15 \text{ h}}{2} \text{ and}$	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou Unit:3 Matching Edge colo Unit:4 Independ Vertex Co Unit:5 Planar G formula – four colou	Subgra y matri ees – C vity: C rs and s: Ma ouring ent se olouring ent se olouring raphs Bride ur conji	aphs: Gr ices, Sul Cut edge Connecti I Hamil tchings of s: Edge Indep ts, Cliqu ngs: Ch :_Plane es - Kun ection	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th ographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices meetivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem. endent sets, Cliques and Vertex Colourings ues: Independent sets – Ramsey's theorem. romatic Number – Brook's Theorem – Chromatic po Planar Graphs and Directed Graphs and planar Graphs - K ₅ non-planar graph – Dual ratowski's theorem (Proof omitted)- The five colourings	e Incic Cycles vity.	1 lence 3. 1 1 1 1 1 3 - F eore	$\frac{15 h}{15 h}$	
Unit:1 Graphs, S Adjacency Trees: Tr Unit:2 Connecti Euler tou Unit:3 Matching Edge colo Unit:4 Independ Vertex Co Unit:5 Planar G formula – four colou	Subgra y matri ees – (vity: C rs and s: Ma ouring ent se olouring raphs Bride ur conji	aphs: Gr ices, Sul Cut edge Connecti I Hamil tchings of s: Edge Indep ts, Cliqu ngs: Ch :_Plane es – Kun ection	Graphs, Subgraphs and Trees raphs and Simple Graphs– Graph Isomorphism – Th bographs – Vertex Degrees – paths and Connection – es and Bonds – cut vertices meetivity, Euler tours and Hamilton Cycles vity – Blocks – Vertex connectivity – Edge connecti ton Cycles: Euler tours - Hamilton Cycles. Matchings and Edge Colourings coverings in Bipartite Graphs – Perfect Matchings. chromatic number – Vizing's theorem. endent sets, Cliques and Vertex Colourings ues: Independent sets – Ramsey's theorem. romatic Number – Brook's Theorem – Chromatic po Planar Graphs and Directed Graphs and planar Graphs - K ₅ non-planar graph – Dual ratowski's theorem (Proof omitted)- The five colourings	e Incic Cycles vity.	1 lence 3. 1 1 1 1 1 1 1 1 5 - F leore	$\frac{15 h}{15 h}$	

Text B	Book(s)
1	L A Bondy and U.S. R. Murty, Graph Theory with Applications, American
1	Elsevier Company Inc., New York, 1976.
	Unit-I: Sections: $1.1 - 1.7, 2.1 - 2.3$
	Unit-II: Sections: $3.1 - 3.2, 4.1 - 4.2$
	Unit-III: Sections: $5.1 - 5.3, 6.1 - 6.2$
	Unit-IV: Sections: 7.1 – 7.2, 8.1 – 8.2, 8.4
	Unit-V: Sections: 9.1 – 9.4, 9.6
Refere	ence Books
1	Frank Harary, Graph Theory, Addison-Wesley, Reading, 1969.
2	M.Murugan, Graph Theory and Algorithms, Second Edition, Muthali Publishing
	House, Chennai, 2018.
3	K. R. Parthasarathy, Basic Graph Theory, Tata McGraw Hill, New Delhi, 1994.
4	Douglas B. West, Introduction to Graph Theory, Prentice Hall of India, 2001.

Mappin	ng with Prog	gramme (Outcom	es							
COs	POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO
CO1		L	Μ	Μ	L	Μ	Μ	Μ	S	Μ	S
CO2		Μ	S	S	Μ	Μ	L	L	S	Μ	S
CO3		S	S	S	Μ	L	L	L	Μ	L	Μ
CO4		L	Μ	S	S	Μ	L	Μ	S	Μ	Μ
CO5		Μ	L	S	Μ	Μ	Μ	Μ	S	Μ	S

Course code	;	ELECTIVE-I: NUMERICAL METHODS	L	Т	Р	С		
Semester-I			4	1	0	3		
Course Obi	ectives							
The main ob	jectives of th	his course are to:						
 To make To know various problem 	e the student v about how numerical di ns.	s understand solving Algebraic and Transcendental and when to use various interpolation function find ifferentiation and integration formulae and using the	l equatio ling the em to so	ns. lve				
Expected Co	ourse Outco	mes:						
On the succ	essful comp	letion of the course, student will be able to:						
1 S	olve probler	ns in numerical differentiation and integration			K	3		
2 S	olve system	of equations using various methods.			K	3		
3 A s	Apply various econd order	s methods to find numerical solution of first and ordinary differential equations.			K	3		
4 E P	Explain the vertexplain the ve	arious methods for solving Boundary Value Characteristic Value Problems			K	2		
5 U s	Jnderstand th olving partia	ne Explicit method and the Crank Nicolson method Il differential equations.	for		K	2		
K1 - Remen	nber; K2 - U	Understand; K3 - Apply; K4 - Analyze; K5 - Evalua	ate; K6 -	Cre	ate			
Unit:1	S	Solution of Nonlinear Equations, Numerical Differentiation and	1	5 ho	urs			
Solution of	Nonlinear l	Equations: Newton's method – Convergence of Ne	ewton's	neth	bo			
Numerical order deriva Trapezoidal	Differentiat atives – Divid rule – Rom	tion and Integration: Derivatives from Differences ded difference, Central-Difference formulas– Comp berg integration – Simpson's rules. (Section 1.3, 1.3)	s tables - posite fo 5, 5.2, 5.	- Hig rmul 3)	gher la of			
Unit:2		Solution of System of Equations	1	5 ho	ours			
The Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method – Methods of Iteration – Jacobi and Gauss Iteration. (Section 2.2-2.5)						_ al		
Iteration. (S		Init:3 Solution of Ordinary Differential Equations 15 h						
Iteration. (S Unit:3	Sol	ution of Ordinary Differential Equations	1	5 ho	urs			
Iteration. (S Unit:3 Taylor seri method. (Se	Sol es method – ection 6.1-6.4	ution of Ordinary Differential Equations Euler and Modified Euler methods – Runge-kutta 1 4)	1: methods	5 ho – N	urs Iilne	's		
Iteration. (S Unit:3 Taylor seri method. (Se Unit:4	Sol es method – ection 6.1-6.4 Bounda	ution of Ordinary Differential Equations Euler and Modified Euler methods – Runge-kutta r 4) ary Value Problems and Characteristic Value Problems	1: methods	5 ho - N 5 ho	urs filne urs	's		

Unit:5	Numerical Solution of Partial Differential Equations	15 hours
Elliptic equatic time-de 8.2)	and Parabolic– Laplace's equation on a rectangular region – Iterative met n - The Poisson equation – Derivative boundary conditions – Solving spendent heat flow (i) The Explicit method (ii) The Crank Nicolson meth	hods for Laplace the equation for od. (Section 8.1,
	Total Lecture hours	75 hours
Text B	ook(s)	
1	Curtis F. Gerald, Patrick O. Wheatley, Applied Numerical Analysis, 7 th E Addison Wesley, (1998).	dition,
Refere	nce Books	
1	S. C. Chapra and P. C. Raymond: Numerical Methods for Engineers, Tata	a McGraw
	Hill, New Delhi, 2000.	
2	S.S. Sastry: Introductory methods of Numerical Analysis, Prentice Hall of	f India, New
	Delhi, 1998.	

3	P. Kandasamy et al., Numerical Methods, S.Chand&Co.Ltd., New Delhi, 2003.
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Mapping with Programme Outcomes											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	Μ	L	S	S	Μ	L	S	Μ	Μ	
CO3	S	Μ	L	S	S	Μ	L	S	Μ	Μ	
CO3	S	Μ	L	S	S	Μ	L	S	Μ	Μ	
CO4	S	S	S	S	Μ	S	S	Μ	L	L	
CO5	S	S	S	S	Μ	S	S	Μ	L	L	

Cour	se		Elective-II FUZZY LOGIC AND FUZZY SETS	L	Т	Р	С		
Seme	ester-I			4	1	0	3		
Cour	se Obj	ectives:							
The n 1. Ide 2. contro	nain ob entify fu . Apply ol.	jectives of f izzy sets an fuzzy logic	this course are to: d perform set operations on fuzzysets. e in various real-life situations such as decision r	making a	nd inv	ventory	Ą		
Ехре	cted Co	ourse Outc	comes:						
On t	the succ	cessful com	pletion of the course, student will be able to:						
1	Gain k betwee	nowledge a en crisp sets	bout the basic types of fuzzy sets and the different and fuzzy sets and the concept of operations on	ence 1 fuzzy so	ets	K1,	K2		
2	Analyz	ze and apply	y the knowledge of fuzzy relations.			K3,1	K4		
3	Develo	p the basic	concepts of fuzzy measures.			K6			
4	Explor	e the conce	pt of uncertainity.			K6			
5	5 Understand the types of uncertainity measures and principles								
		•				IX.5			
K1 -	- Reme	mber; K2 -	Understand; K3 - Apply; K4 - Analyze; K5 - E	valuate;	K6 – (Create			
K1 -	- Reme	mber; K2 -	Understand; K3 - Apply; K4 - Analyze; K5 - E	valuate;	K6 – (Create			
K1 - Unit	- Rementer R t:1	mber; K2 - Criant - Criant - Crisp set	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b	valuate;	K6 – (5 hou icepts	Create rs of Fu:	ZZY		
K1 - Unit Intro Sets	- Rement	mber; K2 - Crian- Crisp set litional prop	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b perties of α-cuts – representation of fuzzy sets	valuate;	K6 – (5 hou acepts	Create rs of Fu:	zzy		
K1 - Unit Intro Sets Unit	- Rementer t:1 oduction s - Add t:2	mber; K2 - Crian- Crisp set litional prop	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b perties of α-cuts – representation of fuzzy sets	valuate; 1 basic cor	K6 – (5 hou acepts 5 hou	rs of Fu:	zzy		
K1 - Unit Intro Sets Unit	- Rementer t:1 oduction s - Add t:2 es of oms	mber; K2 - Crian-Crisp set litional prop Op peration –	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b perties of α-cuts – representation of fuzzy sets bertion on Fuzzy Sets fuzzy complements fuzzy intersection t- N	valuate; 1 basic cor 1 Norms-fu	K6 – (5 hou acepts 5 hou azzy t	rs of Fu:	t -		
K1 - Unit Intro Sets Unit	- Rementer t:1 oduction s - Add t:2 es of o ms t:3	mber; K2 - Crian- Crisp set litional prop Op peration – Po	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b berties of α-cuts – representation of fuzzy sets peration on Fuzzy Sets fuzzy complements fuzzy intersection t- N persibility Theory	valuate; 1 pasic cor 15 Norms-fu	K6 – 0 5 hou acepts 5 hou azzy u hour	rs of Fu: s	zzy t -		
K1 - Unit Intro Sets Unit Type Norr Unit Fuz poss	- Rementer t:1 oduction a – Add t:2 es of o ms t:3 zzy meater sibility	mber; K2 - Cri n- Crisp set litional prop Op peration – Po asures - Ev Theory vers	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b berties of α-cuts – representation of fuzzy sets fuzzy complements fuzzy intersection t- N persibility Theory vidence Theory –possibility Theory - fuzzy sets sus probability Theory	valuate; 1 pasic cor 1 Norms-fu 15 s and pos	K6 – 0 5 hou acepts 5 hou azzy t hour ssibilit	rs of Fu: s union s cy theo	t -		
K1 - Unit Intro Sets Unit Type Norr Unit Fuz poss	- Rementer t:1 oduction a – Add t:2 es of o ms t:3 czy meater sibility 7	mber; K2 - Cri n- Crisp set litional prop Op peration – Po asures - Ev <u>Theory vers</u> Fu	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b berties of α-cuts – representation of fuzzy sets fuzzy complements fuzzy intersection t- N persibility Theory vidence Theory –possibility Theory - fuzzy sets sus probability Theory uzzy Measures, Uncertainty	valuate; 1 pasic cor 1 Norms-fu 15 s and pos 15	K6 – 0 5 hou acepts 5 hou azzy t hour ssibilit	rs of Fu: s union s y theo s	t -		
K1 - Unit Intro Sets Unit Type Norr Unit Fuz poss Unit Rela Clas	- Rementer t:1 oductions - Add t:2 es of oms t:3 zzy means sibility for the second sec	mber; K2 - Cri n- Crisp set litional prop Op peration – Po asures - Ev <u>Theory vers</u> Fu p among cla leasures of	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b berties of α-cuts – representation of fuzzy sets fuzzy complements fuzzy intersection t- N persibility Theory vidence Theory –possibility Theory - fuzzy sets sus probability Theory uzzy Measures, Uncertainty asses of fuzzy measures - Types of Uncertainty- Uncertainty.	valuate; 1 pasic cor 15 Norms-fu 15 s and pos 15 – Measu	K6 – 0 5 hou acepts 5 hou azzy u hour res of	rs of Fu: s rs union s rs rs union s Fuzzin	t -		
K1 - Unit Intro Sets Unit Type Norr Unit Fuz poss Unit	- Rementer t:1 oductions - Add t:2 es of oms t:3 zzy means sibility for the second sec	mber; K2 - Cri n- Crisp set litional prop Op peration – Po asures - Ev Theory vers Fu p among cli leasures of	Understand; K3 - Apply; K4 - Analyze; K5 - E sp Sets and Fuzzy Sets ts: An over view- The Notion of Fuzzy Sets- b berties of α-cuts – representation of fuzzy sets berties of α-cuts – representation of fuzzy sets fuzzy complements fuzzy intersection t- N berties of α-cuts – representation t- N berties of α-cuts	valuate; 1 pasic cor 15 Norms-fu 15 s and pos 15 – Measu 15	K6 – 0 5 hou acepts 5 hou azzy u hour res of hours	rs of Fu: rs inion s ry theo s Fuzzin	t -		

	Total Lecture hours	75 hours
[ext]	Book(s)	
1 Refer	George J. Klir and Tina A. Folger, Fuzzy Sets, Uncertainty and Info printing, Prentice Hall of India Private Limited, 1995. Unit-I: 1.1 – 1.4, 2.1 – 2.2 Unit-II: 3.1 -3.4 Unit-III: 7.1 - 7.5 Unit-IV: 9.1- 9.4 Unit-IV: 9.5-9.7	ormation, Fourth
1	George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic - Theory Prentice-Hall of India Private Limited	and Applications
Relate	ed Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://giocher.wordpress.com/chapter-2-par-2-2-fuzzy-relations-a extension- principle/	nd-the-
2	https://nptel.ac.in/courses/108/104/108104157/	

Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	L	Μ	S	L	Μ	L	S	Μ	S	S		
CO2	Μ	S	Μ	S	S	S	S	S	S	S		
CO3	S	S	L	Μ	S	S	L	Μ	L	S		
CO4	S	S	L	Μ	S	S	L	Μ	L	S		
CO5	Μ	S	Μ	S	S	S	S	S	Μ	S		

Course code	Elective-II : MATHEMATICAL PROCRAMMING	L	Т	Р	С
Semester-I		4	1	0	3
Course Objec	tives:				A
The main obje	ctives of this course are to:				
1. To make the	students understand and solving LPP using various metho	d.			
2. To understa	nd the concept of Kuhn tucker method.				
Expected Cou	rse Outcomes:				
On the succes	sful completion of the course, student will be able to:				
1 Underst	and the formulation of linear programming problem.			K2	r
2 Remem	ber various techniques to solve real life problem.			K1	
3 Underst	and and solve the non-linear programming problem.			K2	,K5
4 Apply t	e fundamental concepts of Parametric Programming and	Integer L	linear	K3	
Programn	ing	unto V	6 Cr	aata	
KI - Kemenn	\mathbf{K} = Onderstand; \mathbf{K} = Appry; \mathbf{K} = Anaryze; \mathbf{K} = Eva	aluale; K	0 - Cr	eale	
Unit:1	Linear Programming Problem	1	5 hou	rs	
Formulation of	f Linear Programming problem – Graphical solution - Sin	nplex pro	cedur	e –	
method of pe	nalty – Two – Phase technique – special cases in simplex r	nethod			
applications -	Duality – Economic interpretation of duality – Primal Du	al Comp	utatioi	ıs	
Unit:2	Dynamic	15	5 hour	S	
<u>Canada 1'a a 1 a</u>	Programming Problem	-1			
Deterministic	Dynamic Programming	algorithi	n –		
Unit:3	Integer Linear Programming Problem	1	5 hou	rs	
Parametric P	rogramming and Integer Linear Programming				
Unit:4	Classical Optimization Theory	15	5 hour	S	
Inconstrained l	Problem – Necessary and Sufficient conditions, Constraine	d Problei	ms –		
neonstrained	method and Lagrangian method) and un equality constrai	ns (Exter	nsion		
Equality (Jacob	nethod and Kunn-Tucker Conditions)				
Equality (Jacob f Lagrangian r					
Equality (Jacob of Lagrangian r Unit:5	Non-Linear Programming	15	hour	5	

onsti	rained algorithms – Separable, quadratic, geometric programming.	
	Total Lecture hours 75 he	ours
ext]	Book(s)	
1	Hamdy A. Taha, "Operations Research", (sixth edition) Prentice – Hall of India P	rivat
-	Limited. New Delhi. 1997.	11, at
	Unit I: Chapter 2 : Section 2.1 - 2.3	
	Chapter 3 : Section 3.1 - 3.5	
	Chapter 4 : Section 4.1 - 4.6	
	Chapter 7 : Section 7.6 only	
	Unit II: Chapter 4 : Section 4.7 only	
	Chapter 7 : Section 7.4, 7.5.1 and 7.5.2	
	Chapter 10 : Section 10.2 - 10.5	
	Unit III: Chapter 7 : Section 7.7	
	Chapter 9 : Section 9.1 - 9.3	
	Unit IV: Chapter 20 : Section 20.1 - 20.3 omit 20.2.2.	
	Unit V: Chapter 21 : Section 21.1, 21.2 omit 21.2.4, 21.25 and 21.2.6.	
efer	rence Books	
1	FS Hiller and LL ieberman Introduction to Operation Research (7th Edition) T	'ata
1	- McGraw Hill Publishing Company New Delhi 2001	ata
2	C Beightler D Philips and B Wilde Foundations of Ontimization (2nd Edition	n)
2	Prentice Hall Pvt Ltd New York 1979	,
3	M s Bazaraa II Jarvis and H D Sharall Linear Programming and Network	
5	flow. John Wiley. New York, 1990	

Mappi	Mapping with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	L	Μ	S	L	Μ	L	S	Μ	S	S			
CO2	Μ	S	Μ	S	S	S	S	S	S	S			
CO3	S	S	L	Μ	S	S	L	Μ	L	S			
CO4	S	S	L	Μ	S	S	L	Μ	L	S			
CO5	Μ	S	Μ	S	S	S	S	S	Μ	S			

Course code	Core Paper IV:ADVANCED ALGE	BRA L	Т	Р	С
Semester-II		6	0	0	5
Course Objectives:					1
The main objectives of	f this course are to:				
1. Develop a strong	foundation in linear algebra that provide a basic for adv	ance dstudies.			
2. Study of Linear	Transformations, Algebra of Polynomials, Invariant spac	e and their			
properties.					
3. Give particular a	ttention to canonical forms of linear transformations, dia matrices and determinents	gonalizations of	f lin	ear	
transformations,	manices and determinants.				
Expected Course Ou	tcomes:				
On the successful co	mpletion of the course, student will be able to:				
Understand the basic	c concepts of Linear transformations, characteristic roots	K2			
and matrices of linea	ar transformation and its applications.		- 1		
prime factorization	of a polynomial	K2, K	.4		
Understand the basic	c concepts of determinants and its additional properties.	K2			
Recognize the conce	epts of Invariant subspaces and diagonalization process.	K5			
Analyze canonical F	Form, Jordan Form and Rational canonical Form.	K4			
K1 - Remember; K2	- Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate	e; K6 - Create			
TT 1 1					
Unit:1	Linear Transformations	18 hours	5		
transformations by n	hatrices – Linear functionals.	IIICal			
Unit:2	Algebra of Polynomials	18 hours	5		
The algebra of polyn	iomials –Polynomial ideals - The prime factorization of a	a polynomial -			
Determinant function	15.				
Unit:3	Determinants	18 hours	5		
Permutations and the	e uniqueness of determinants – Classical adjoint of a (s	quare) matrix –	Inv	ers	e
of an invertible matr	ix using determinants – Characteristic values – Annihila	ing polynomial	s.		
Unit:4	Diagonalization	18 hours	5		
Invariant subspaces	- Simultaneous triangulations - Simultaneous diagonaliz	ation – Direct-s	sum		
decompositions = In	variant direct sums – Primary decomposition theorem.				
decompositions in					
Unit:5	The Rational and Jordan Forms	18 hours	5		
Unit:5 Cyclic subspaces – C	The Rational and Jordan Forms Cyclic decompositions theorem (Statement only) – Generation	18 hours alized Cayley -	-		
Unit:5 Cyclic subspaces – C Hamilton theorem -	The Rational and Jordan FormsCyclic decompositions theorem (Statement only) – Gener Rational forms – Jordan forms.	18 hours alized Cayley -	<u>}</u>		

Text Boo	bk (s)		
1	Kenneth M Hoffman and R	ay Kunze, Lin	ear Algebra, Second Edition, Prentice-Hall of
	India Pvt. Ltd, New Delhi,	2013.	
	UNITI:	Chapter3	: Sections3.1-3.5
	UNITII:	Chapter4	: Sections 4.1, 4.2, 4.4,4.5
		Chapter5	: Sections 5.1,5.2
	UNITIII:	Chapter5	: Sections 5.3,5.4
		Chapter6	: Sections6.1-6.3
	UNITIV:	Chapter6	: Sections 6.4 -6.8
	UNITV:	Chapter7	: Sections 7.1 –7.3
	•	•	

Reference Books

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

Ma	Mapping with Programme Outcomes												
С	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
С	S	S	Μ	L	Μ	S	S	S	Μ	Μ			
С	Μ	S	S	Μ	L	S	S	S	Μ	Μ			
С	S	S	Μ	L	Μ	S	S	S	Μ	Μ			
С	L	Μ	L	S	Μ	S	Μ	Μ	L	L			
С	Μ	S	S	Μ	L	S	S	S	Μ	Μ			

Course code		Core Paper VI: REAL ANALYSIS-II	L	Т	Р	С	
Semester-I			6	0	0	5	
Course Obj	ectives:						
The main ob	ectives of th	is course are to:					
1.	To convey c	concepts of real valued functions in detail.					
2.	To provide t	he deep knowledge about sequences and serie	es.				
3.	To make a c	lear difference between differentiability and c	ontinu	iity			
4.	To know so	me basic theorems.					
Expected C	ourse Outco	mes:					
On the succ	essful compl	letion of the course, student will be able to:					
1 Ap	ply the Riem	ann Stieltjes integral and bring its properties a	and			K3	
2 Re	nembering o	f sequences and series along with its propertie	es			K1	
3 An	alyze the cor	ncept of linear transformation and find the extractions	reme			K4	
1 661	Values of implicit functions.						
4 Un	derstand the	fundamental concept of Lebesgue measure.				K2	
4 Un 5 Ev K1 - Remen Unit:1 Vleasure on th Functions - B	derstand the aluate the con nber; K2 - U Measure Real line- orel and Lebe	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability	e Integ Evaluat Regula	gral e; K(18 arity	6 - Cr 8 hou - Mea	K2 K5 eate rs isurable	
4Un5EvK1 - RemenUnit:1Measure on the Functions - B Chapter - 2 S	derstand the aluate the con nber; K2 - U Measure Real line- orel and Lebo	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability 5 (de Barra)	e Integ Evaluat Regula	gral e; K(18 arity	6 - Cr 8 hou - Mea	K2 K5 eate rs isurable	
4Un5EvK1 - RemerUnit:1Measure on thFunctions - BChapter - 2 \$Unit:2Unit:2	derstand the aluate the com nber; K2 - U Measure are Real line- orel and Lebo fec 2.1 to 2.5 Integra	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability 5 (de Barra) ation of Functions of a Real variable	e Integ Evaluat Regula	gral e; K(18 arity 18	5 - Cr 3 hou - Mea 3 hou	K2 K5 eate rs isurable	
4 Un 5 Ev K1 - Remer Unit:1 Measure on th Functions - B Chapter - 2 S Unit:2 Integration Integrals Chapter - 3	derstand the aluate the com nber; K2 - U Measur le Real line- orel and Lebo lec 2.1 to 2.5 Integra of Non- neg	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability 5 (de Barra) ation of Functions of a Real variable gative functions - The General Integral - Ri and 3.4 (de Barra)	e Integ Evaluat Regula Regula	gral te; K(18 arity 18 n and	5 - Cr 3 hou - Mea 3 hou Lebe	K2 K5 eate rs isurable	
4Un5EvK1 - RemenderUnit:1Measure on the functions - BChapter - 2 \$Unit:2IntegrationIntegrationIntegrationChapter - 2 \$Unit:2IntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegrationIntegration	derstand the aluate the com nber; K2 - U Measure Real line- orel and Lebo lec 2.1 to 2.5 Integra of Non- neg Sec 3.1,3.2 Fourie	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability 6 (de Barra) ation of Functions of a Real variable gative functions - The General Integral - Ri and 3.4 (de Barra) er Series and Fourier Integrals Lessem of functions - The theorem on be	e Integ Evaluat Regula Regula	gral te; K(18 arity 18 n and 18 proxim	5 - Cr 3 hou - Mea 3 hou Lebe	K2 K5 eate rs isurable rs esgue rs - The	
4 Un 5 Ev K1 - Remer Unit:1 Measure on th Functions - B Chapter - 2 S Unit:2 Integration Integrals Chapter - 2 S Unit:2 Integrals Chapter - 2 S Unit:3 Introduction Fourier serie Coefficients - crigonometric representation Sufficient co Cesarosumma approximation Chapter 11 :	Integration of a function of the result	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability i (de Barra) ation of Functions of a Real variable gative functions - The General Integral - Ri and 3.4 (de Barra) er Series and Fourier Integrals I system of functions - The theorem on be ction relative to an orthonormal system - Fischer Thorem - The convergence and repress Riemann - Lebesgue Lemma - The Dirichle artial sums of Fourier series - Riemann's r convergence of a Fourier series at burier series- Consequences of Fejes's theo 1 to 11.15 (Apostol)	e Integ Evaluat Regula Regula Regula demann demann st app Prop entatio t Integ locali a pa rem -	gral ae; K(18 arity 18 arity 18 n and 18 proxim perties on pro- grals zation urticul The	3 hou 3 hou 4 hou 5 of 5 of	K2 K5 eate rs surable rs esgue rs rs rs rs esgue rs integra orem orem erstrass	
4 Un 5 Ev K1 - Remer Unit:1 Measure on the surface on	A set of imple derstand the aluate the com- mber; K2 - U Measure Real line- orel and Lebore dec 2.1 to 2.5 Integra of Non- neg Sec 3.1,3.2 Fourie Orthogonal s of a func The Riesz-F series - The for the para onditions for bility of For theorem Sections 11.	fundamental concept of Lebesgue measure. mplex integration and the benefits of Lebesgue Inderstand; K3 - Apply; K4 - Analyze; K5 - E rable sets and Measurable functions Lebesgue Outer Measure - Measurable sets - esgue Measurability 6 (de Barra) ation of Functions of a Real variable gative functions - The General Integral - Ri and 3.4 (de Barra) er Series and Fourier Integrals I system of functions - The theorem on be ction relative to an orthonormal system - Fischer Thorem - The convergence and repres Riemann - Lebesgue Lemma - The Dirichle artial sums of Fourier series - Riemann's r convergence of a Fourier series at burier series- Consequences of Fejes's theo 1 to 11.15 (Apostol)	e Integ Evaluat Regula Regula Regula demann demann st app Prop entatio t Integ locali a pa rem -	gral ae; K(18 arity 18 arity 18 n and 18 proxim perties on pro grals zation urticul The	3 hou 3 hou 3 hou 3 hou 3 hou 3 hou a hou b hou b hou a hou b 	K2 K5 eate rs surable rs esgue rs n - The Fourier integra orem - erstrass	

Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of \mathbb{R}^n to \mathbb{R}^1 **Chapter 12 : Section 12.1 to 12.14 (Apostol)**

Unit:5	Implicit Functions and	18 hours
	Extremum Problems	

Functions with non-zero Jacobian determinants – The inverse function theorem-The Implicit function theorem-Extrema of real valued functions of severable variables-Extremum problems with side conditions.

Chapter 13 : Sections 13.1 to 13.7 (Apostol)

Total Lecture hours	90 hours

Text Book(s)

1.G. de Barra, *Measure Theory and Integration*, Wiley Eastern Ltd., New Delhi, 1981. (for Units I and II)

2.TomM.Apostol : *Mathematical Analysis*, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. (for Units III, IV and V)

Reference Books

1. Burkill, J.C. *TheLebesgue Integral*, Cambridge University Press, 1951 2. Munroe, M.E. *Measure and Integration*. Addison-Wesley, Mass. 1971.

3. Roydon, H.L. Real Analysis, Macmillan Pub. Company, New York, 1988.

4. Rudin, W. Principles of Mathematical Analysis, McGraw Hill Company, New York, 1979.

course coue	Core Paper VI:PARTIAL DIFFERENTIAL EQUATIONS	L	Т	Р	C
Semester-II		6	0	0	4
Course Objec	tives				
The main obje	ctives of this course are to:				
1 Introduce di	fferent methods to solve partial differential equation				
2 A aquira kno	vuladas in classification of partial differential equations and the p	natha	da ta		vo
	whedge in classification of partial differential equations and the n	netno	us ic	5 501	ve.
3. Enables the	students to find the solution of Partial Differential Equation of pr	actica	al		
	e in Englieering, Flysics, etc.,				
Expected Cor	irse Autcomes.				
On the succes	ssful completion of the course, student will be able to:				
1 Unders	tand and remember the physical situations with real world proble	ems to)	K1	
constru	ict mathematical models using partial differential equations and st	tudy		&K	2
the me	thods to solve.				
2 Analyz	te the type of partial differential equations and different methods t	to		K4	
3 Evalua	te Laplace equation and analyze its applications.			K5	
4 Apply	variable separable method to solve Laplace and Diffusion equation	on		K3	
5 Findin	g the appropriate method to solve the partial differential equations	S		K6	
V1 Damage					
KI - Kemem	per; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	K6 -	Cre	eate	
Unit:1	per; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equation	K6 - 18 h	ours	ate	
Unit:1 Partial Differ Problem for differential e system of Fir	Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equati first order equations – Linear Equations of the first order – I quations of the first order – Cauchy's method of characteristic st order Equations – Solutions satisfying Given Condition, Jacobi	K6 - 18 h ions Nonli cs – i's me	Cre ours - C near Corr ethoo	auch auch pai npat 1.	ıy's tial ible
Unit:1 Partial Differ Problem for differential e system of Fir Unit:2	Der; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equations first order equations – Linear Equations of the first order – I quations of the first order – Cauchy's method of characteristic st order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order	K6 - 18 he ions Nonli cs – i's me 18	Cre ours – C near Con ethoo	auch auch pai npat d. Irs	ıy's tial ible
Whit:1 Partial Differ Problem for differential e system of Fir Unit:2 The Origin or coefficients - Integral Tran	Der; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equations first order equations – Linear Equations of the first order – I quations of the first order – Cauchy's method of characteristic st order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order f Second Order Equations – Linear partial Differential Equation - Equations with variable coefficients – Separation of variables – Sforms – Non – linear equations of the second order.	K6 - 18 he ions Nonli cs - 's me 18 ons w - The	Cree ours – C near Cor ethoo hou ith c	auch auch painpat: d. urs	ny's rtial ible tant
Vnit:1 Partial Differ Problem for differential e system of Fir Unit:2 The Origin of coefficients – Integral Tran	ber; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equatifierst order equations – Linear Equations of the first order – I equations of the first order – Cauchy's method of characteristic st order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order f Second Order Equations – Linear partial Differential Equatio - Equations with variable coefficients – Separation of variables - Sforms – Non – linear equations of the second order. Laplace's Equation	K6 - 18 ho ions Nonli cs - 's me 18 ons w - The 18	 Cree ours ours ours connean Connean<!--</td--><td>auch auch painpat: d. urs const ethoc</td><td>ny's rtial ible</td>	auch auch painpat: d. urs const ethoc	ny's rtial ible
Vnit:1 Partial Differ Problem for differential e system of Fir Unit:2 The Origin of coefficients – Integral Tran Unit:3 Elementary value problem Variables – L Equation.	Der; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equation first order equations – Linear Equations of the first order – I quations of the first order – Cauchy's method of characteristic st order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order f Second Order Equations – Linear partial Differential Equatio - Equations with variable coefficients – Separation of variables - sforms – Non – linear equations of the second order. Laplace's Equation solutions of Laplace equation – Families of Equipotential Surfans - Separation of variables – Surface Boundary Value Problems Problems with Axial Symmetry – The Theory of Green's Funct	K6 - 18 h ions Nonli cs - 's me 18 ons w - 18 ons w - 18 acces s - Solution Solution	Cree ours – C near Correthoo hou ith ce me 3 ho epar for	auch auch pain pat: d. urs const ethoc urs ound ation Lapl	ay's trial ible
Vnit:1 Partial Differ Problem for differential e system of Fir Unit:2 The Origin of coefficients – Integral Tran Unit:3 Elementary value probler Variables – D Equation.	Der; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equations first order equations – Linear Equations of the first order – I equations of the first order – Cauchy's method of characteristics order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order f Second Order Equations – Linear partial Differential Equation - Equations with variable coefficients – Separation of variables - Seforms – Non – linear equations of the second order. Laplace's Equation solutions of Laplace equation – Families of Equipotential Surfaces Problems with Axial Symmetry – The Theory of Green's Functor The Wave Equation	K6 -18 hionsNonlics -'s me's me18ons w- The18acess - Section	Cree ours – C near Cor ethoo hou ith c e me g hou – Bo epar for	auch auch painpat: d. urs const ethoc urs ound ation Lapl	ay's rtial ible tant l of lary n of ace
K1 - RememUnit:1Partial DifferProblem fordifferential esystem of FirUnit:2The Origin ofcoefficients -Integral TranUnit:3Elementaryvalue problerVariables - DEquation.Unit:4The OccurredThree dimensional T	Der; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equations first order equations – Linear Equations of the first order – I quations of the first order – Cauchy's method of characteristics order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order f Second Order Equations – Linear partial Differential Equations - Equations with variable coefficients – Separation of variables - Sforms – Non – linear equations of the second order. Laplace's Equation solutions of Laplace equation – Families of Equipotential Surfaces Problems with Axial Symmetry – The Theory of Green's Function The Wave Equation mce of the wave equation in Physics – Elementary Solution Wave equations – Vibrating membrane, Application of the calculation	K618 hionsNonlics's me's me18ons w- The18acesssSsssssssssssssssof	Cree ours - C near Cor ethoo hou ith c e me 3 ho - Bo epar for the vari	auch auch pain pat: d. urs const ethoc ation Lapl Ond ation	ay's rtial ible tant l of lary n of ace e – ns –
Unit:1 Partial Differ Problem for differential e system of Fir Unit:2 The Origin or coefficients - Integral Tran Unit:3 Elementary value probler Variables - 1 Equation. Unit:4 The Occurre dimensional Y Three dimensional Y	ber; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Partial Differential Equations of the First Order rential Equations – Origins of First Order Differential Equatifirst order equations – Linear Equations of the first order – 1 quations of the first order – Cauchy's method of characteristicst order Equations – Solutions satisfying Given Condition, Jacobi Partial Differential Equations of the Second Order f Second Order Equations – Linear partial Differential Equatio - Equations with variable coefficients – Separation of variables - sforms – Non – linear equations of the second order. Laplace's Equation solutions of Laplace equation – Families of Equipotential Surfaces Problems with Axial Symmetry – The Theory of Green's Funct The Wave Equation nce of the wave equation in Physics – Elementary Solution Wave equations – Vibrating membrane, Application of the calculation	K618 hionsNonlics's me's me18ons w- The18acessSSS	Cree ours - C near Correthoo hou ith c e me 3 ho epar for the vari	auch auch pain pat: d. urs const ethoc ation Lapl Oncation	ny's rtial ible tant l of lary n of ace e – ns –

Unit:	5	The Diffusion Equation	18 hours
Eleme	entary Solut	ions of the Diffusion Equation – Separation of variables – The	use of Integral
Transf	forms – The	e use of Green's functions.	
		Total Lecture hours	90 hours
Text I	Book(s)		
1	Ian Snedd Book Con	on, Elements of Partial Differential Equations, McGraw Hill Inpany, New Delhi, 1983.	nternational
D 4			
Refer	ence Books	3	
1	M. D. Rais New Delh	singhania, Advanced Differential Equations, S. Chand and Coni, 2001.	mpany Ltd.,
2	K. Sankara Hall of Inc	aRao, Introduction to Partial Differential Equations, Second ec lia, New Delhi, 2006.	lition, Prentice-
3	J. N. Shari Narosa Pu	ma and K. Singh, Partial Differential Equations for Engineers a blishing House, 2001.	and Scientists,
Relate	ed Online (Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://w	ww.youtube.com/watch?v=bPPWp65qpIA	

Mapping w	ith Prog	ramme	Outcom	es						
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Μ	Μ	Μ	L	Μ	Μ	Μ	S	L	Μ
CO2	Μ	Μ	S	Μ	S	S	S	S	Μ	L
CO3	L	S	Μ	S	S	S	Μ	S	L	L
CO4	Μ	S	Μ	S	S	S	S	S	L	L
CO5	Μ	S	Μ	S	S	S	Μ	S	Μ	Μ

		STATISTICS		T	Р	C
Semester-III		4	4	0	0	3
Course Object	ives:					
The main objec	tives of this c	ourse are to:				
1. Enables to	learn differer	nt aspects of statistics.				
2. Acquire k	nowledge abo	ut moments and properties of theoretical distributions.				
3. Study unb	lasedness and	consistency of limiting distributions.				
Expected Cou	rse Outcomes	S:				
On the succes	sful completio	on of the course, student will be able to:				
1 Reme	mbering the u	inderstanding the basic concepts such as statistics,			K	1,
proba	bility and ran	dom variables.			K	2
2 Appl	ying the conce	epts and methods to find the moments of the distributions.			K	3
3 Study	multivariate	distributions and the independence of random			K	5
varia	oles. Further e	evaluating the marginal distributions from bivariate				• 4
4 Analy	ze and study	the properties of some discrete as well as			K	4
5 Unde	rstand the con	vergence of distributions and central limit theorem			K	2
K1 - Rememb	er: K2 - Unde	erstand: K3 - Apply: K4 - Applyze: K5 - Evaluate: K6 - C	rea	ite		
	<u></u>					
Unit:1 Introduction Independence	- Set Theory –Random Va	Probability and Distributions / - The Probability Set Function - Conditional Probriables.	<u>12</u> babi	ho ility	ours y ai	nd
Unit:1 Introduction Independence Unit:2	- Set Theory –Random Va	Probability and Distributions / - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions	12 Dabi	ho ility ho	ours and ours	nd
Unit:1 Introduction Independence Unit:2 Probability Expectations - Multivariate Bivariate Ran	- Set Theory -Random Va Pr and Distribution Important Ind Distribution dom Variables	Probability and Distributions / - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Sorequalities. as: Distributions of Two Random Variables - Transs.	12 Dabi	ho ility ho S	purs 7 an purs peci	ial
Unit:1 Introduction Independence Unit:2 Probability Expectations - Multivariate Bivariate Rand	- Set Theory -Random Va Pr and Distribution Important In- dom Variables	Probability and Distributions / - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Some qualities. us: Distributions of Two Random Variables - Transs.	12 Dabi	ho ility ho S rma	purs and purs pect tior	ial
Unit:1 Introduction Independence Unit:2 Probability Expectations - Multivariate Bivariate Rand Unit:3 The Binomial	- Set Theory -Random Va Pr and Distribution dom Variables and Related I	Probability and Distributions γ - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Sone equalities. us: Distributions of Two Random Variables - Transs. Some Special Distributions Distributions - The Poisson Distribution - The Γ, γ2, and β	12 Dabi 12 me sfor 12 3	ho ility ho S	purs and purs peci- tior	ial ns:
Unit:1 Introduction Independence Unit:2 Probability Expectations - Multivariate Bivariate Rand Unit:3 The Binomial Distributions.	- Set Theory -Random Va Pr and Distribution dom Variables and Related I	Probability and Distributions γ - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Some equalities. us: Distributions of Two Random Variables - Transs. Some Special Distributions Distributions - The Poisson Distribution - The Γ, χ2, and β	12 Dabi	ho ility ho S ma	purs y and purs peci- tior	nd ial
Unit:1 Introduction Independence Unit:2 Probability Expectations - Multivariate Bivariate Rand Unit:3 The Binomial Distributions. Unit:4	- Set Theory -Random Va Pr and Distribution dom Variables and Related I Some S	Probability and Distributions γ - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Son equalities. us: Distributions of Two Random Variables - Transs. Some Special Distributions Distributions - The Poisson Distribution - The Γ, χ2, and β Special Distributions (continued), Unbiasedness, Consistency and Limiting Distributions	12 Dabi 12 me sfor 12 3 12	ho ility ho S rma 2 ho 2 ho	purs purs peci tior	ial is:
Unit:1 Introduction Independence Unit:2 Probability Expectations Multivariate Bivariate Rand Unit:3 The Binomial Distributions. Unit:4 Some Special	- Set Theory -Random Va Pr and Distribution dom Variables and Related I Some S Distribution	Probability and Distributions γ - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Sorequalities. as: Distributions of Two Random Variables - Transs. Some Special Distributions Distributions - The Poisson Distribution - The Γ, χ2, and β Special Distributions (continued), Unbiasedness, Consistency and Limiting Distributions - t and F-Distributions s (continued): The Normal Distribution- t and F-Distribution	12 Dabi	ho ility ho S ma 2 ho 1s.	purs y an purs peci tior	
Unit:1 Introduction Independence Unit:2 Probability Expectations Multivariate Bivariate Rand Unit:3 The Binomial Distributions. Unit:4 Some Special Unit:5	- Set Theory -Random Va Pr and Distribution dom Variables and Related I Some S Distribution	Probability and Distributions γ - The Probability Set Function - Conditional Probriables. robability and Distributions (continued) and Multivariate Distributions robability and Distributions (continued) and Multivariate Distributions utions: Expectation of a Random Variables - Sone equalities. is: Distributions of Two Random Variables - Transs. Some Special Distributions Distributions - The Poisson Distribution - The Γ, χ2, and β Special Distributions (continued), Unbiasedness, Consistency and Limiting Distribution- t and F-Distributions s (continued): The Normal Distribution- t and F-Distribution Some Special Distributions (continued), Unbiasedness, Consistency and Limiting Distribution- t and F-Distribution	12 Dabi 12 me sfor 12 3 12 12 12 12 12 12 12 12 12 12	ho illity ho S ma 2 ho 2 ho ns.	purs purs peci tior purs	
		Total Lecture hours	60 hours			
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Гext	Book(s)					
1	Robert V. H	logg, Allen T. Craig and Joseph W. McKean, Introduction to Mat	hematical			
	Statistics, S	ixth Edition, Pearson Education, 2005.				
	Unit-I:	1.1 –1.5				
	Unit-II:	1.8 - 1.10, 2.1 - 2.2				
	Unit-III:	3.1 –3.3				
	Unit-IV:	3.4, 3.6,				
	Unit-V:	4.1 -4.4				
Refe	rence Books					
Refe	rence Rooks					
Refe	rence Books Michael J. (Crawley, The R Book, John Wiley & Sons, Second Edition (2013)				
Refe 1 2	rence Books Michael J. (MarekFisz.	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley.				
Refe 1 2 3	rence Books Michael J. (MarekFisz, Vijay K. Ro	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. Solution and A.K. Md. EhsanesSaleh, An Introduction to Probability	and			
Refe 1 2 3	rence Books Michael J. C MarekFisz, Vijay K. Ro Statistics, W	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. Dhatgi and A.K. Md. EhsanesSaleh, An Introduction to Probability Viley India, Second Edition (2001).	and			
Refe 1 2 3 4	rence Books Michael J. (MarekFisz, Vijay K. Ro Statistics, W M. Rajagop	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. ohatgi and A.K. Md. EhsanesSaleh, An Introduction to Probability Viley India, Second Edition (2001). oalan and P. Dhanavanthan, Statistical Inference, PHI Learning Pv	and t. Ltd.,			
Refe 1 2 3 4	rence Books Michael J. (MarekFisz, Vijay K. Ro Statistics, W M. Rajagop New Delhi	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. Dhatgi and A.K. Md. EhsanesSaleh, An Introduction to Probability Viley India, Second Edition (2001). Dalan and P. Dhanavanthan, Statistical Inference, PHI Learning Pv (2012).	and t. Ltd.,			
1 2 3 4	rence Books Michael J. C MarekFisz, Vijay K. Ro Statistics, W M. Rajagop New Delhi	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. ohatgi and A.K. Md. EhsanesSaleh, An Introduction to Probability Viley India, Second Edition (2001). valan and P. Dhanavanthan, Statistical Inference, PHI Learning Pv (2012).	and t. Ltd.,			
Refe 1 2 3 4 Rela	rence Books Michael J. (MarekFisz, Vijay K. Ro Statistics, W M. Rajagop New Delhi (ted Online C	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. Ohatgi and A.K. Md. EhsanesSaleh, An Introduction to Probability Viley India, Second Edition (2001). Onlana and P. Dhanavanthan, Statistical Inference, PHI Learning Pv (2012).	and t. Ltd.,			
Refe 1 2 3 4 Rela 1	rence Books Michael J. C MarekFisz, Vijay K. Ro Statistics, W M. Rajagop New Delhi (ted Online C https://npto	Crawley, The R Book, John Wiley & Sons, Second Edition (2013) Probability Theory and Mathematical Statistics, John Wiley. Dhatgi and A.K. Md. EhsanesSaleh, An Introduction to Probability Viley India, Second Edition (2001). Dalan and P. Dhanavanthan, Statistical Inference, PHI Learning Pv (2012). Contents [MOOC, SWAYAM, NPTEL, Websites etc.] el.ac.in/courses/111/104/111104032/#	and t. Ltd.,			

Mapping with Programme Outcomes											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	
CO1	S	Μ	Μ	L	L	Μ	S	S	S	S	
CO2	Μ	S	Μ	L	S	S	Μ	S	S	S	
CO3	S	Μ	S	Μ	Μ	S	S	Μ	L	S	
CO4	Μ	Μ	S	Μ	Μ	S	Μ	S	Μ	S	
CO5	Μ	Μ	L	Μ	S	Μ	S	S	S	S	

Course co	ode	Elective-III: STATISTICAL DATA ANALYSIS USING R PROGRAMMING	L	Т	Р	С			
Semester	-III		4	0	0				
Course O	biectives:								
The main	objectives of	this course are to:							
 Enab Acqu Anal 	les to learn di iire knowledg yze the statisti	fferent aspects of statistical data analysis. e about R programming in statistics. ical data using R programming.							
Expected	Course Outo	comes:							
On the s	uccessful com	pletion of the course, student will be able to:							
1	Apply R prog	ramming and understand different data sets			K	3			
2	Apply R Prog	ramme and construct graphs and charts			K	3			
3	Analyze the d Programming	ata and know descriptive statistics by using R			K	4			
4	Apply R Programming to test the hypothesis of the study								
5	Predict the da	ta and take decisions through R programming.			K	5			
K1 - Rei	member; K2 -	Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6	- Cre	ate					
Unit:1		Introduction to R programming	12	2 ha	ours				
Arithme Studio In Data str Logical - Special	tic Operators - nstalling and le uctures, varial Data - Vectors Values.	- Logical Operations - Using Functions - Getting Help in R a bading packages. bles, and data types in R: Creating Variables - Numeric, s - Data Frames - Factors -Sorting Numeric, Character, and I	and Q Char Facto	Quit acte or V	ting er a ecto	R nd rs			
Unit:2		Data Visualization using R	12	2 ha	ours				
Scatter I axes, lab	Plots - Box Pl els, add legen	ots - Scatter Plots and Box and-Whisker Plots Together -C ds, and add colours.	Custo	miz	e pl	ot			
Unit:3		Descriptive statistics in R	12	2 hc	ours				
3.6	s of central ten s, describe fun	ndency - Measures of variability - Skewness and kurtosis - S actions, and descriptive statistics by group.	umm	ary					
function			11) hc	rc				
Measure function Unit:4		Testing of Hypothesis using R	14	i nu	ul S				
Measure function Unit:4 T-test, P	aired Test, cor	Testing of Hypothesis using R relation, Chi Square test, Analysis of Variance and Correlation	ion						
Measure function: Unit:4 T-test, P	aired Test, cor	Testing of Hypothesis using R relation, Chi Square test, Analysis of Variance and Correlati	ion						

U	nit:5	Predictive Analytics	12 hours						
Li	Linear Regression model, Non-Linear Least Square, multiple regression analysis, Logistic								
Regr	Regression, Panel Regression Analysis, ARCH Model, GARCH models, VIF model.								
		Total Lecture hours	60 hours						
Te	ext Book(s)								
1	Crawley,	M. J. (2006), "Statistics - An introduction using R", John Wiley, Lo	ondon 32						
2	Purohit,	S.G.; Gore, S.D. and Deshmukh, S.R. (2015), "Statistics using R", s	econd edition.						
	Narosa P	ublishing House, New Delhi.							
3	Shahabal	ba B. (2011), "Biostatistics with R", Springer, New York							
4	Braun &	Murdoch (2007), "A first course in statistical programming with R"	, Cambridge						
	Universit	y Press, New Delhi.	-						

Mapping with Programme Outcomes											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	S	Μ	Μ	L	L	Μ	S	S	S	S	
CO2	Μ	S	Μ	L	S	S	Μ	S	S	S	
CO3	S	Μ	S	Μ	Μ	S	S	Μ	L	S	
CO4	Μ	Μ	S	Μ	Μ	S	Μ	S	Μ	S	
CO5	Μ	Μ	L	Μ	S	Μ	S	S	S	S	

Course code		Elective -IV:MODELLING AND SIMULATION	L	Т	P	С			
Semester-II			4	0	0	3			
Course Object	tives:								
The main object 1. Defin organ 2. Deve 3. Anal 4. Expl	ctives of this ne the basics nizations. elop simulat ysis of Simu ain Verifica	s course are to: s of simulation modeling and replicating the practical s ion model using heuristic methods. alation models using input analyzer, and output analyz tion and Validation of simulation model.	situatio zer	ons in					
Expected Cou	rse Outcom	1es:							
On the succes	sful comple	tion of the course, student will be able to:							
1 Describe paradigm	the role of i	mportant elements of discrete event simulation and m	nents of discrete event simulation and modeling						
2 Conceptua originating	alize real wo	orld situations related to systems development decision ce requirements and goals.	ns,		K	2			
3 Develop s models. 4 Interpret f	Develop skills to apply simulation software to construct and execute goal-driven system models.								
environme	ent	derstand: K3 - Apply: K4 - Applyze: K5 - Evaluate: 1	K6 - C1	reate		.5, 11-			
	Jei, K2 - UI		XU - C	leate					
Unit:1		Introduction to Simulation	1	12 hou	irs				
Simulation, A a system.	Advantages,	Disadvantages, Areas of application, System environ	ment, c	ompo	nent	s of			
Unit:2		Model of a system	1	2 hou	rs				
Model of a sy Queuing syste	stem, types ems, Simula	of models, steps in a simulation study. Simulation Exation of Inventory System, Other simulation examples.	amples	: Sim	ulatio	on of			
Unit:3	Gene	eral Principles and Random Numbers	12	hour	'S				
Concepts in d	iscrete - eve heduling, R	nt simulation, event scheduling/ Time advance algorit andom Numbers: Properties, Generations methods.	thm, sii	mulati	on				
using event sc		1 <i>,</i>		Analysis of Simulation Data 12 hours					
using event sc Unit:4		Analysis of Simulation Data	12	hours	5				
using event sc Unit:4 Input Modelli Goodness of f	ng: Data co ît tests, Sele	Analysis of Simulation Data llection, Identification and distribution with data, para ection of input models without data.	12 meter of	hour s estima	s tion,	,			
using event sc Unit:4 Input Modelli Goodness of f Unit:5	ng: Data co it tests, Sele	Analysis of Simulation Data llection, Identification and distribution with data, para ection of input models without data. Analysis of Simulation Data (Contd)	12 imeter of 12	hours estima 2 hou	s tion, rs	,			
using event sc Unit:4 Input Modelli Goodness of f Unit:5 Multivariate a Verification, 0	ng: Data co it tests, Sele and time seri Calibration a	Analysis of Simulation Data Ilection, Identification and distribution with data, para action of input models without data. Analysis of Simulation Data (Contd) Ites analysis - Verification and Validation of Model – N and Validation of Models.	12 Imeter of 12 Model 1	hours estima 2 hou Buildi	s tion, rs ng,	, , 			

Text	t Book(s)
	r
1	Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, Discrete Event system
	Simulation, Pearson Education, Asia, 4th Edition, 2007, ISBN: 81-203-2832-9.
2	Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978,
	ISBN: 81-203-0140-4.
3	Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill
	International Editions – Industrial Engineering series, 4th Edition, ISBN: 0-07-100803-
	9.
4	NarsinghDeo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd
	Edition, 2004, ISBN : 0-87692-028-8.
Re	eference Books
1	Averill M. Law, "Simulation Modeling and Analysis", 4/e, Tata McGraw-Hill, 2017.
2	Lawrence M. Leemis and Stephen K. Park, "Discrete – Event Simulation: A First Course", Pearson
	Education, 2006.

Mapping with Programme Outcomes												
COs POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	S	L	Μ	Μ	Μ	L	Μ	S	S	Μ		
CO2	S	Μ	Μ	L	L	L	L	Μ	Μ	Μ		
CO3	L	Μ	Μ	S	L	L	L	Μ	Μ	Μ		
CO4	Μ	Μ	L	L	Μ	L	L	L	Μ	S		
CO5	Μ	Μ	Μ	L	L	L	L	S	Μ	M		

Semester-II		Elective -IV:NEURAL NETWORKS	L	LT				
			4	0	3			
Course Object	tives:				-			
The main objec	ctives of thi	s course are to:						
 To know t investigate Acquire in Apply neu 	he main fun e the princip n-depth know and network	ndamental principles and techniques of neural network models and applications. Towledge in Non-linear dynamics to classification and generalization problems.	ork syste	ems a	nd			
Expected Cou	rse Outcon	nes:						
On the succes	sful comple	etion of the course, student will be able to:						
1 Understan	nd and anal	yze different neutron network models			K2,	K4		
2 Understan perceptio	2 Understand the basic ideas behind most common learning algorithms for multilayer K2 perceptions, radial-basis function networks.							
3 Describe	Describe Hebb rule and analyze back propagation algorithm with examples.							
4 Study cor	Study convergence and generalization and implement common learning algorithm,							
5 Study dir	ectional der	rivatives and necessary conditions for optimality an	d to		K.	5		
evaluate o	quadratic fu	unctions.						
K1 - Rememb	ber; K2 - U1	nderstand; K3 - Apply; K4 - Analyze; K5 - Evaluat	e; K6 - (Create	e			
Unit.1	1	Nouron Model and Network Architectures	1	12 ho	1100			
Mathematical Network-Lear	Neuron Mo ming Rules	odel- Network Architectures- Perceptron-Hamming	Networ	·k- Ho	pfiel	h		
		·			-			
Unit:2		Perceptron Architectures		12 ho	urs			
Unit:2 Perceptron Ar Learning -Lin	chitectures ear Associa	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup tor.	pervised	12 ho Hebb	urs vian			
Unit:2 Perceptron Ar Learning -Lin	chitectures ear Associa	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup ator.	pervised	12 hor Hebb	urs ian			
Unit:2 Perceptron Ar Learning -Lin Unit:3 The Hebb Rul Multilayer Per	chitectures ear Associa le-Pseudo in rceptrons.	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup itor. Supervised Hebbian Learning nverse Rule-Variations of Hebbian Learning-Back I	pervised 1 Propagat	12 ho Hebb 2 hou tion -	urs ian Irs			
Unit:2 Perceptron Ar Learning -Lin Unit:3 The Hebb Rul Multilayer Per	chitectures ear Associa le-Pseudo in rceptrons.	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup itor. Supervised Hebbian Learning nverse Rule-Variations of Hebbian Learning-Back I Back Propagation	pervised 1 Propagat	12 ho Hebb 2 hou 2 hou	urs ian Irs			
Unit:2 Perceptron Ar Learning -Lin Unit:3 The Hebb Rul Multilayer Per Unit:4 Back propaga Optimum Poin	chitectures ear Associa le-Pseudo in rceptrons. tion Algorit nts-Taylor s	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup itor. Supervised Hebbian Learning nverse Rule-Variations of Hebbian Learning-Back I Back Propagation thm-Convergence and Generalization - Performance series.	Dervised 1 Propagat 12 es Surfa	12 hou Hebb 2 hou tion - 2 hou ces ar	urs ian urs rs id			
Unit:2 Perceptron Ar Learning -Lin Unit:3 The Hebb Rul Multilayer Per Unit:4 Back propaga Optimum Poin	chitectures ear Associa le-Pseudo in rceptrons. tion Algorit nts-Taylor s Performa	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup ator. Supervised Hebbian Learning nverse Rule-Variations of Hebbian Learning-Back I Back Propagation thm-Convergence and Generalization - Performance series.	Dervised 1 Propagat 12 12	12 hou Hebb 2 hou ces ar 2 hou	urs ian irs rs id			
Unit:2 Perceptron Ar Learning -Lin Unit:3 The Hebb Rul Multilayer Per Unit:4 Back propaga Optimum Poin Unit:5 Directional De Performance (chitectures ear Associa le-Pseudo in rceptrons. tion Algorit nts-Taylor s Performa erivatives - Optimizatio	Perceptron Architectures and Learning Rule with Proof of Convergence. Sup itor. Supervised Hebbian Learning nverse Rule-Variations of Hebbian Learning-Back I Back Propagation thm-Convergence and Generalization - Performance series. Ince Surfaces and Performance Optimizations Minima-Necessary Conditions for Optimality-Quar ns-Steepest Descent-Newton's Method-Conjugate	Dervised 1 Propagat 1 2 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 4 4 4 4 4 4 4 4 4 4 4 4	12 hou Hebb 2 hou tion - 2 hou ces ar 2 hou unctio t.	urs ian urs rs nd rs ns-			

Martin T. Hagan, Howard B. Demuth and Mark Beale, Neural Network Design, Vikas Publishing House, New Delhi,2002.

Reference Books

James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education, 2003.

Robert J. Schalkoff, Artificial Neural Network, McGraw-Hill International Edition, 1997.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://nptel.ac.in/courses/117/105/117105084/

https://nptel.ac.in/courses/106/106/106106184/

Mapping with Programme Outcomes												
COs POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	S	L	Μ	Μ	Μ	L	Μ	S	S	Μ		
CO2	S	Μ	Μ	L	L	L	L	Μ	Μ	Μ		
CO3	L	Μ	Μ	S	L	L	L	Μ	Μ	Μ		
CO4	Μ	Μ	L	L	Μ	L	L	L	Μ	S		
CO5	Μ	Μ	Μ	L	L	L	L	S	Μ	Μ		

Course code	Skill Enhancement Course- NME-I:	L	Т	Р	С
	OFFICE AUTOMATION AND ICT				
	TOOLS (PRACTICAL)				
Semester-III		2	0	2	2

Course Objectives:

The main objectives of this course are to:

1. To learn about basic commands of MS Word, MS Excel and MS Access.

Expected Course Outcomes:

On the su	On the successful completion of the course, student will be able to:							
1	Acquire practical knowledge about MS-Word, MS-Excel,	K2, K3						
2	Understand about MS-PowerPoint and Ms-Access.	K2						
3	Apply mathematical symbols into MS-word and MS-Power point.	K3						
K1 - Ren	K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create							

LIST OF PRACTICALS

MS Word:

1. Preparation of word document (Typing, aligning, Font Style, Font Size, Text editing, colouring, Spacing, Margins)

2. Creating and Editing a table (Select no of rows, Select no of columns, row heading, column heading, column width, row width, row height, spacing text editing)

3. Formatting a table (insert rows/columns, delete rows/columns, cell merging / splitting, Cell alignment)

4. Preparation of letters using mail merge.

5. Demonstration of Find, Replace, Cut, Copy and paste texts in a word document.

MS Excel:

6. Creation of Charts, Graphs and Diagrams.

7. Calculation of Measures of central Tendency 8. Calculation of Standard Deviation.

MS Power Point:

9. Preparation of slides in power point.

10. Creation of Animation Pictures.

MS Access:

11. Creation of simple reports using MS Access.

General

12. Create a Google meet link.

13. Create a Google form.

Text Book(s)

1 Andy Channelle, Beginning Open Office 3: From Novice to Professional, A Press series, Springer-Verlog, 2009.

Reference Books

1 Perry M. Greg, Sams Teach Yourself Open Office.org All In One, Sams Publications, 2007.

Mapping with	Progran	nme Out	comes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	Μ	L	Μ	Μ	Μ	L	L	Μ	Μ
CO2	Μ	L	L	Μ	Μ	Μ	L	L	Μ	Μ
CO3	L	Μ	L	Μ	Μ	S	L	S	S	Μ
CO4	Μ	L	L	Μ	Μ	Μ	L	L	Μ	Μ
CO5	L	Μ	Μ	Μ	Μ	S	L	S	S	Μ

Course code		Core Paper VII: COMPLEX ANALYSIS	L	Т	Р	С
Semester-III			6	0	0	5
Course Objectiv	ves:					
The main objecti	ves of this c	course are to:				
 Define and a Enable the s on the study Study Cauch Cauchy's th 	ecognize th tudents to t ny's integra eorem and e	he basic properties of the complex numbers he differentiability of complex functions and the re l formula, local properties of analytic functions, ge evaluation of definite integral.	esult	ts re al fo	elated	l of
Expected Cours	e Outcome	s:				
On the successf	ul completi	on of the course, student will be able to:				
1 Remember 1 Remember 1	pering the c	oncept of Analytic function and as a mapping on			K1	
2 Understa know ab	and Cauchy out poles ,	's Integral Formula on open sets on the plane and residues and singularities.			K2	
3 Apply the valuation	ne Cauchy's on of defini	s integral formula in residue theorems and in te integrals.			K3,	K4
4 Analyze Analytic	and represe Function.	ent the sum function of a power series as an			K5	
5 Study an function	nd Understa and its app	nd periodic function, Weierstrass ℘ lications.			K2,	K5
K1 - Remember	; K2 - Und	erstand; K3 - Apply; K4 - Analyze; K5 - Evaluate	; K	6 - (Creat	e
Unit:1	Comp Formu	lex Integration and Cauchy's Integral 1la		18	hour	S
Fundamental Th Arcs– Cauchy's formula: The in- derivatives.	neorems: Li Theorem f dex of a poi	ne Integrals – Rectifiable Arcs - Line Integrals as l for a Rectangle – Cauchy's Theorem in a Disk - Ca int with respect to a closed curve – The Integral for	Fun uch rmu	ctio y's la –	ns of Integ Higi	gral her
Unit:2	Local	Properties of Analytic Functions		18 ł	nour	s
Local Properties and poles – The	s of Analyt Local Map	ic Functions: Removable Singularities - Taylor's pping – The Maximum principle.	thec	oren	n – Z	ero
Unit:3	The Ca	lculus of Residues and Harmonic Functions		18	hour	s
The Calculus of I Definite Integrals value Property –	Residues: T s - Harmon Poisson's f	The Residue theorem – The Argument Principle – In the functions: Definitions and Basic Properties – Formula – Schwarz's Theorem.	Eva The	luat Mo	ion c ean	of -

Unit:4	Series and Product Developments, Partial fractions and	18 hours	
	Factorization		
Power Series Exp	ansions: Weierstrass's Theorem – The Taylor Series – The Laur	rent Series -	
Partial fractions an	nd Factorization: Partial Fractions – Infinite Products.		

Unit	:5	Canonical Products	18 hours
anor	nical Products – The	Riemann Mapping theorem : Statement and Proof - T	he Schwarz
Chri	istoffel Formula – A	closer look at harmonic functions: Functions with Me	an -value
ope	rty - Harnack's Princ	ciple.	
		Total Lecture hours	90 hours
Гext	Book(s)		
1	L. V. Ahlfors, Cor	nplex Analysis, McGraw Hill Education	
_	(India) Pvt. L	.td. 2013	
	UNITI:	Chapter4 : Sections 1.1 –1.5	
		Chapter 4 : Sections $2.1 - 2.3, 3.1, 3.2$ and 3.4	
	UNITII:	Chapter4 : Sections $3.1 - 3.4$	
	UNITIII:	Chapter4 : Sections $5.1 - 5.3$, $6.1 - 6.4$	
	UNITIV:	Chapter5 : Sections 1.1 – 1.3, 2.1, 2.2	
	UNITV:	Chapter5 : Section 2.3	
		Chapter6 : Sections 1.1, 2.2, 3.1, 3.2	
<u>Refe</u>	rence Books		
1	S. Ponnusamy and	H. Silverman, A Complex Variable with applications	,
	Birkhauser, Boston	n, 2006.	
2	Karunakaran V, C	omplex Analysis, Narosa Publishing House Pvt. Ltd, S	Second
	Edition, New Delh	ni, 2006.	
3	Roopkumar R, Co	mplex Analysis, Dorling Kinderley Pvt. Ltd, New De	lhi, 2015.

Mapping with Prog	ramme	Outcom	les							
COs POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	Μ	L	L	Μ	Μ	Μ	L	Μ
CO2	Μ	S	Μ	L	Μ	Μ	Μ	Μ	L	Μ
CO3	Μ	S	Μ	S	Μ	Μ	S	S	Μ	Μ
CO4	Μ	S	S	S	Μ	S	S	Μ	L	S
CO5	S	Μ	S	S	Μ	S	S	Μ	Μ	S

		Core Paper VIII: PROBABILITY THEORY	L	Т	Р	С
Semester-II	[6	0	0	5
Course Obje	ectives:					
The main obj	ectives of	f this course are to:				
1. To intro	duce axio	pmatic approach to probability theory, to study some stat	istic	al		
characte characte	eristics, di eristic fune	screte and continuous distribution functions and their pro- ction and basic limit theorems of probability.	ope	rties	,	
Expected Co	ourse Out	tcomes:				
On the succ	essful cor	mpletion of the course, student will be able to:				
1 Ren prot	nembering Dability ar	g the understanding the basic concepts such as statistics, and random variables.			K1,	K2
2 To s	solve Reg	ression of the first and second types.			K5	
3 To s	solve prob	plems on Cauchy and Laplace distributions.			K5	
4 To e Koli	explain an mogorov	nd solve problems on Kolmogorov Inequality and Strong Law of large numbers.			K2,	K4
K1 - Remer	nber; K2	- Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate	; K	6 - (Creat	e
Linit.1		Pandam Evants and Pandam Variables	1	8 h/	MIRC	
CIIIVI	1 Random Events and Random Variables	-	• •••			
	۰ <i>۲</i> ۲	lependent events – Random Variables – Distribution Fun	ictic	n –	Join	t
Variables – 1 Sections 2.1	– Margin Functions I to 2.9)	dependent events – Random Variables – Distribution Funnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Conductional Distribution – Independents of random variables.	nctio at ra Cha	on — ndo: ptei	Join m r 2 :	t
Variables – Sections 2.1 Unit:2	n – Margin Functions I to 2.9)	dependent events – Random Variables – Distribution Funnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Chapter 1: Sections	t rational control of the control of	on – ndo: pter 8 ho	Join m r 2 :	t
Unit:2 Xpectation- I foments of ra 1 to 3.8)	I – Margin Functions I to 2.9) I to 2.9) I Moments andom ve	dependent events – Random Variables – Distribution Funnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Condition variables) (Chapter 1: Sections 1.1 to 1.7, Condition – The Chebyshev Inequality – Absolute moments – Order Cortors – Regression of the first and second types. (Chapter 1) (Chapter 2) (C	t ra Cha 1 er p er 3	on — ndo: pter 8 ho arar : S	join m 2 : ours neter ectio	 t ns
Unit:2 Variables – 1 Sections 2.1 Unit:2 Xpectation- 1 foments of ra .1 to 3.8) Unit:3	I – Margin Functions I to 2.9) I Moments andom ve	dependent events – Random Variables – Distribution Funnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Constructions) Parameters of the Distribution – The Chebyshev Inequality – Absolute moments – Order of the first and second types. (Chapter Characteristic functions)	t ra Cha 1 er p er 3	n = ndo pter 8 hd arar rar	Durs	
Distribution variables – 1 Sections 2.1 Unit:2 xpectation- N foments of ra .1 to 3.8) Unit:3 Properties of semi0invaria Determinatio function of n 4 : Sections of	A – Margin Functions I to 2.9) I to 2.9) I Moments andom ve character nts – char n of distri- nultidimen 4.1 to 4.7	lependent events – Random Variables – Distribution Funnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Chapter 1: Sections 1.1 to 1.7, Chapters of the Distribution Parameters of the Distribution – The Chebyshev Inequality – Absolute moments – Order tors – Regression of the first and second types. (Chapter Characteristic functions Firstic functions ristic functions – Characteristic functions and moments – racteristic function of the sum of the independent random ibution function by the Characteristic function –	1 er p er 3 er s eris as. (on – ndo pter 8 h arar : S 	Join m 2 : ours neter ectio	t s ns
Distribution variables – 1 Sections 2.1 Unit:2 xpectation- 1 foments of ra .1 to 3.8) Unit:3 Properties of semi0invaria Determinatio function of m 4 : Sections of Unit:4	A – Margin Functions I to 2.9) I to 2.9) I Moments andom ve character nts – char n of distr nultidimen 4.1 to 4.7	Idependent events – Random Variables – Distribution Funnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Chapter 1: Sections 1.1 to 1.7, Chapters of the Distribution Parameters of the Distribution – The Chebyshev Inequality – Absolute moments – Ordectors – Regression of the first and second types. (Chapter 1: Characteristic functions Firstic functions – Characteristic functions and moments – cracteristic function of the sum of the independent random ibution function by the Characteristic function – Characteristic function Char	1 er p er 3 er s er s s. ($\frac{\text{on } -}{\text{ndo:}}$ $\frac{\text{ndo:}}{\text{pter}}$ $\frac{8 \text{ hd}}{\text{arar}}$ $\frac{18 \text{ h}}{\text{riab}}$ $\frac{18 \text{ h}}{\text{riab}}$	Join m r 2 : purs neter ectio les – npter hou	t rss
Unit:3 Properties of ra Distribution variables – 1 Sections 2.1 Unit:2 xpectation- 1 Ioments of ra 1 to 3.8) Unit:3 Properties of semi0invaria Determinatio function of n 4 : Sections 4	A – Margin Functions I to 2.9) I Moments andom ve character nts – char n of distri- nultidimer 4.1 to 4.7	lependent events – Random Variables – Distribution Furnal Distribution – Conditional Distribution – Independents of random variables. (Chapter 1: Sections 1.1 to 1.7, Chapter 1: Sections 1.1 to 1.7, Chapters of the Distribution Parameters of the Distribution – The Chebyshev Inequality – Absolute moments – Ordetors – Regression of the first and second types. (Chapter 1: Characteristic functions) Firstic functions – Characteristic functions and moments – cracteristic function of the sum of the independent random ibution function by the Characteristic function – Characteristic function – Characteristic function – Characteristic function – Characteristic function function by the Characteristic function – Charact	1 er p er 3 er s a. (n - ndo pter 8 he arar riab riab tic Cha 18 riab tic Triab	Join m r 2 : ours neter ectio les – npter hou	t rss

Unit	t:5 Limit Theorems	18 hours
Stoch distril Cheby Lapui Stron	hastic convergence – Bernaulli law of large numbers – Convergence of s bution functions – Levy-Cramer Theorems – de Moivre-Laplace Theorem yshev, Khintchine Weak law of large numbers – Lindberg Theorem – novTheroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Ko g Law of large numbers. (Chapter 6 : Sections 6.1 to 6.4, 6.6 to 6.9 , 6	equence of em – Poisson, olmogorov 5.11 and 6.12.)
	Total Lecture hour	s 90 hours
Text		
I	M. Fisz, <i>Probability Theory and Mathematical Statistics</i> , John Wiley a York, 1963.	nd Sons, New
lefere	ence Books	
1	R.B. Ash, Real Analysis and Probability, Academic Press, New York	
-		k, 1972
2	K.L.Chung, A course in Probability, Academic Press, New York, 19	x, 1972 74.
2 3	K.L.Chung, <i>A course in Probability</i> , Academic Press, New York, 19 R.Durrett, <i>Probability : Theory and Examples</i> , (2 nd Edition) Duxbury 1996.	k, 1972 74. 7 Press, New Yor
2 3 4	 K.L.Chung, A course in Probability, Academic Press, New York, 19 R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury 1996. V.K.RohatgiAn Introduction to Probability Theory and Mathematica Eastern Ltd., New Delhi, 1988(3rd Print). 	k, 1972 74. 7 Press, New Yor Il Statistics, Wile
2 3 4 5	 K.L.Chung, A course in Probability, Academic Press, New York, 19 R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury 1996. V.K.RohatgiAn Introduction to Probability Theory and Mathematica Eastern Ltd., New Delhi, 1988(3rd Print). S.I.Resnick, A Probability Path, Birhauser, Berlin, 1999. 	k, 1972 74. 7 Press, New Yor Il Statistics, Wile

Mapping with Pro	gramm	e Outco	mes							
Cos \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	Р
CO1	S	S	Μ	L	L	Μ	Μ	Μ	L	Μ
CO2	Μ	S	Μ	L	Μ	Μ	Μ	Μ	L	Μ
CO3	Μ	S	Μ	S	Μ	Μ	S	S	Μ	Μ
CO4	Μ	S	S	S	Μ	S	S	Μ	L	S
CO5	S	Μ	S	S	Μ	S	S	Μ	Μ	S

course coue		Core Paper IX: TOPOLOGY	L	Т	Р	C
Semester-III			6	0	0	4
Course Objective	es:					<u> </u>
The main objectiv	res of this co	urse are to:				
1. To introduce t	he concepts	of point-set topology with emphasis on continuous fu	inctio	ns.		
homeomorph	ism ,connec	tedness, compactness, countability and separation axio	oms.			
Expected Course	Outcomes:					
On the successfu	l completior	n of the course, student will be able to:				
1 Acquire	e knowledge	e about various types of topological spaces and their pro-	operti	ies	k	(4
2 Discuss	s connected	spaces, the components of a space			k	2
3 Apply t	the propertie	es and derive the proofs of theorems.			K	33
4 Constru	lict a variety	of examples and counter examples in topology			K	(
5 Unders	tand the pro-	perties of the compact spaces and analyse the different	types	s of	k	2
compac	ctness.				k	[/
K1 - Remember;	K2 - Under	stand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 -	- Crea	ate		
TI 94 - 1	Т		<u> </u>	101		
Unit:1		opological Spaces and Continuous functions	, to m	18 no	urs	
nroduct topology	i on X v V	- The subspace topology - Closed sets and limits poir	t iopo	Tontir	11- וסוור	10
functions		- The subspace topology - Closed sets and mints pon	ns - v	Contin	luot	15
Tunetions						
Unit:2	Topolo	ogical Spaces and Continuous functions (Contd)	1	8 hoi	ars	
~	ropon		1			
- *****	Topon	and Connectedness				
The Product To	pology - 7	and Connectedness The metric topology - Sequence lemma- Uniform	limit	t theo	oren	1-
The Product To Connected space	ppology - 7 s - Connecte	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of	limit	t theo ctedn	oren less.	1-
The Product To Connected space	ppology - 7 s - Connecte	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of	limit	t theo ctedn	oren less.	1-
ourse Objectives: Image: Construct of the course are to: he main objectives of this course are to: Image: Construct of point-set topology with emphasis on continuous functions, homeomorphism ,connectedness, compactness, countability and separation axioms. xpected Course Outcomes: Image: Construct of the course, student will be able to: Image: Construct a variety of examples of topological spaces and their properties K4 2 Discuss connected spaces, the components of a space K2 3 Apply the properties and derive the proofs of theorems. K3 4 Construct a variety of examples and counter examples in topology K6 5 Understand the properties of the compact spaces and analyse the different types of topological Spaces and Examples - Analyze; K5 - Evaluate; K6 - Create Unit:1 Topological Spaces and Continuous functions 18 hours Types of Topological Spaces and Examples - Basics for a topology - The order topology - The product topology on X x Y - The subspace topology - Closed sets and limits points - Continuous functions. 18 hours The Product Topology - The metric topology - Sequence lemma- Uniform limit theorem-Connected spaces - Connected subspaces of the real line - Components and Local connectedness. 18 hours Ompactness 18 hours Compact spaces - Compact subspaces of the real line - Uniform continuity theorem - Limit						
The Product To Connected space Unit:3 Compact spaces	ppology - T s - Connecte	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of Compactness subspaces of the real line - Uniform continuity theorem	limit conne 1 - Lin	t theo ctedn 18 hou	oren iess. urs	1-
ourse code Core Paper IX: TOPOLOGY L T P C smester-III 6 0 0 5 ourse Objectives:						
The Product To Connected space Unit:3 Compact spaces Point Compactne	main objectives of this course are to: To introduce the concepts of point-set topology with emphasis on continuous functions, homeomorphism ,connectedness, compactness, countability and separation axioms. ected Course Outcomes: a the successful completion of the course, student will be able to: Acquire knowledge about various types of topological spaces and their properties K4 Discuss connected spaces, the components of a space Apply the properties and derive the proofs of theorems. K3 Construct a variety of examples and counter examples in topology K6 Understand the properties of the compact spaces and analyse the different types of K2, compactness. I - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create it:1 Topological Spaces and Continuous functions 18 hours 18 hours pes of Topological Spaces and Continuous functions (Contd) 18 hours netions. 18 hours netict spaces - Connected subspaces of the real line - Components and Local connectedness. 18 hours nit:2 Topological Spaces and Continuous functions (Contd) 18 hours nit:3 Compactness 18 hours ordpacet spaces - Connected subspaces of the real line - Components and Local connectedness. 18					
The Product To Connected space Unit:3 Compact spaces Point Compactne Unit:4	opology - T s - Connecte - Compact s ess – comple	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of Compactness subspaces of the real line - Uniform continuity theorem subspaces of the real line - Uniform continuity theorem te metric spaces –compactness in metricspaces. Countability and Separation Axioms	limit conne 1 - Lin	t theo ectedn 18 hou nit 8 hou	urs	1-
The Product To Connected space Unit:3 Compact spaces Point Compactnee Unit:4 First and Second	- Compact sess – comple	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of Compactness subspaces of the real line - Uniform continuity theorem ete metric spaces – compactness in metricspaces. Countability and Separation Axioms paces - Lindeloff and Separable spaces - Countability and Separation Axioms	limit conne 1 - Lim 1 axiom	t theo ectedn 18 hou nit 8 hou ns - Tl	urs he	<u> </u>
The Product To Connected space Unit:3 Compact spaces Point Compactne Unit:4 First and Second separation axiom	opology - 7 s - Connecte - Compact s ess – comple countable s as - Normal s	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of Compactness subspaces of the real line - Uniform continuity theorem ete metric spaces – compactness in metricspaces. Countability and Separation Axioms paces - Lindeloff and Separable spaces - Countability a spaces - The Uryshon's lemma.	limit conne 1 - Lim 1 axiom	t theo ectedn 18 hou nit 8 hou ns - Tl	urs	<u>1</u> -
The Product To Connected space Unit:3 Compact spaces Point Compactne Unit:4 First and Second separation axiom	Popology - 7 s - Connecte - Compact s ess – comple countable s s - Normal s	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of Compactness subspaces of the real line -Uniform continuity theorem state metric spaces – compactness in metricspaces. Countability and Separation Axioms paces - Lindeloff and Separable spaces - Countability aspaces - The Uryshon's lemma.	limit conne 1 - Lin 1 axiom	t theo ectedn 18 hou nit 8 hou ns - Tl	urs	<u>]</u>
The Product To Connected space Unit:3 Compact spaces Point Compactne Unit:4 First and Second separation axiom Unit:5	<pre>pology - 7 s - Connecte - Compact s ess - comple countable s s - Normal s Countable</pre>	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local of Compactness subspaces of the real line - Uniform continuity theorem ete metric spaces – compactness in metricspaces. Countability and Separation Axioms paces - Lindeloff and Separable spaces - Countability a spaces - The Uryshon's lemma. bility and Separation Axioms and Tychonoff	limit conne 1 - Lim 1 axiom	t theo ectedn 18 hou nit 8 hou as - Tl 3 hou	urs he	<u> </u>
The Product To Connected space Unit:3 Compact spaces Point Compactne Unit:4 First and Second separation axiom Unit:5 The UrysohnMet	rization The	and Connectedness The metric topology - Sequence lemma- Uniform ed subspaces of the real line - Components and Local ed subspaces of the real line - Components and Local ed subspaces of the real line - Uniform continuity theorem ete metric spaces – compactness in metricspaces. Compactness Subspaces of the real line - Uniform continuity theorem ete metric spaces – compactness in metricspaces. Countability and Separation Axioms paces - Lindeloff and Separable spaces - Countability a spaces - The Uryshon's lemma. bility and Separation Axioms and Tychonoff Theorem corem - The Tychonoff theorem	limit conne 1 - Lim 1 axiom 18	t theo ectedn 18 hou nit 8 hou ns - Tl 3 hou	urs he	<u>1</u> .
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1	James R. Munkres, Topology, Second Edition, Prentice-Hall of India, New Delhi, 2006.
Refer	ence Books
1	G. F. Simmons, Introduction to Topology and Modern Analysis, Tata McGraw-Hill Edition,
	New Delhi, 2004.
2	Fred H. Croom, Principles of Topology, Cengage India Pvt Ltd, New Delhi, 2009.
3	Seymour Lipschutz, Schaum's Outline of Theory and Problems of General Topology,
	McGraw-Hill Edition, New Delhi, 2006.
Relate	ed Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/content/storage2/courses/111106054/Topology%20complete%20course.
	p df
2	https://www.youtube.com/watch?v=Oe3Qjk3t0go&lc=UghijV07WCAwpHgCoAEC
3	https://www.youtube.com/watch?v=2OMPmrHEO2M

Mapping w	ith Prog	ramme (Outcome	s						
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO
CO1	L	Μ	S	L	Μ	Μ	S	L	Μ	S
CO2	S	Μ	Μ	L	L	S	S	Μ	S	Μ
CO3	S	Μ	S	L	Μ	S	S	S	Μ	S
CO4	S	S	S	Μ	L	S	S	S	Μ	S
CO5	S	Μ	S	Μ	Μ	S	S	S	Μ	S

Course coo	de	Core Paper X: MECHANICS	L	Т	Р	C
Semester-1	III		6	0	0	4
Course Ob	biectives:					
The main	objectives	s of this course are to:				
1. underst Hamil examp	tand the co lton's Prin ples.	oncepts of generalized coordinates, virtual work, Lagrange' ciple. To discuss the applications of the above concepts wi	's equation th suitab	ons a le	nd	
2. Proficie about	ent in deri canonical	vation and application of Hamilton-Jacobi equations 3. gain transformations, Lagrange and Poisson brackets	n knowle	dge		
Expected (Course O	utcomes:				
On the suc	ccessful co	ompletion of the course, student will be able to:				
1	Underst coordina	and the basic concepts of the mechanical system, generalize ates, work, energy and momentum.	ed		Kź	2
2	Solve ar with exa	nd analyze the Lagrange's equations and integrals of motion umples.	n		K4 K4	1, 5
3	Underst	and the Hamilton's Principle and other variational principle	es and ga	lin	Kź	2
4	Underst	and and develop the Hamilton's Principal function and Har	milton		Ke	-
5	Gat fam	ilier with cononical transformations, conditions of cononici			V4	5
5 K1 - Rem	Get fam of a tran	iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	ity K6 - Cro	eate	K.	5
5 K1 - Rem Unit:1	Get fam of a tran nember; K	 iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts 	ity K6 - Cro	eate	K.	5
5 K1 - Rem Unit:1 Mechanic Momentu	Get fam of a tran nember; K cal system im.	 iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts – Generalized Coordinates – Constraints – Virtual Work – 	ity K6 - Cro Energy a	eate 18 and	K.	5 5 S
5 K1 - Rem Unit:1 Mechanic: Momentu:	Get fam of a tran nember; K cal system im.	 iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts – Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations 	ity K6 - Cro Energy a	eate 18	hour	5 5 ••••••••••••••••••••••••••••••••••
5 K1 - Rem Unit:1 Mechanica Momentur Unit:2 Derivation Integrals of	Get fam of a tran hember; K cal system im. ns of Lagr of Motion	 iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations ange's Equations: Derivations of Lagrange's Equations – E 	ity K6 - Cro Energy a 18 I Examples	eate 18 J and hour	K:	5 5
5 K1 - Rem Unit:1 Mechanic: Momentu: Unit:2 Derivation Integrals of Unit:3	Get fam of a tran nember; K cal system im. ns of Lagr of Motion	 iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations ange's Equations of Lagrange's Equations – E Hamilton's Equations 	ity K6 - Cro Energy a 18 I Examples	eate 18) and hour 3 – 1000	K: hour	5 5
5 K1 - Rem Unit:1 Mechanica Momentua Unit:2 Derivation Integrals of Unit:3 Hamilton	Get fam of a tran nember; K cal system im. ns of Lagr of Motion n's Princip	iliar with canonical transformations, conditions of canonicists of the start of	ity K6 - Cro Energy a 18 I Examples	eate 18) and houn 3 -	K: hour	5 5
5 K1 - Rem Unit:1 Mechanica Momentua Unit:2 Derivation Integrals of Unit:3 Hamilton Unit:4	Get fam of a tran hember; K cal system im. ns of Lagr of Motion n's Princip	iliar with canonical transformations, conditions of canonicisisformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts – Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations ange's Equations: Derivations of Lagrange's Equations – E Hamilton's Equations le – Hamilton's Equations.	ity K6 - Cro Energy a 18 I Examples 18 I	eate 18 3 and hour 3 - 10ur	K: hour	5 5
5 K1 - Rem Unit:1 Mechanica Momentua Unit:2 Derivation Integrals of Unit:3 Hamilton	Get fam of a tran hember; K cal system im. ns of Lagr of Motion n's Princip	iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts – Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations ange's Equations: Derivations of Lagrange's Equations – E Hamilton's Equations le – Hamilton's Equations. Hamilton – Jacobi Theory e function – Hamilton – Jacobi Equation – Separability.	ity K6 - Cro Energy a 18 I Examples 18 I	eate 18 3 and hour 3 - 10ur	K: hour	5 5 78
5 K1 - Rem Unit:1 Mechanica Momentua Unit:2 Derivation Integrals of Unit:3 Hamilton Unit:4 Hamilton' Unit:5	Get fam of a tran hember; K cal system im. ns of Lagr of Motion n's Princip	iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts – Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations ange's Equations: Derivations of Lagrange's Equations – E Hamilton's Equations le – Hamilton's Equations. Hamilton – Jacobi Theory e function – Hamilton – Jacobi Equation – Separability.	ity K6 - Cro Energy a Examples 18 h	eate 18 j and hour 	K:	5 5
5 K1 - Rem Unit:1 Mechanica Momentua Unit:2 Derivation Integrals of Unit:3 Hamilton Unit:4 Hamilton' Unit:5 Differentia	Get fam of a tran nember; K cal system im. ns of Lagr of Motion n's Princip 's Principl ial forms a	iliar with canonical transformations, conditions of canonicis sformation in terms of Lagrange and Poisson brackets 2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; Introductory Concepts – Generalized Coordinates – Constraints – Virtual Work – Lagrange's Equations ange's Equations: Derivations of Lagrange's Equations – E Hamilton's Equations le – Hamilton's Equations. Hamilton – Jacobi Theory e function – Hamilton – Jacobi Equation – Separability. Canonical Transformations nd Generating Functions – Lagrange and Poisson Brackets	ity K6 - Cro Energy a Examples 18 h 18 h 18 h	eate 18 j and houn 3 - 10ur ours 10ur	K: hour rs	<u> </u>

	Total Lecture hours	90 hours
Text	Book(s)	
1	D. T. Greenwood, Classical Dynamics, Dover Publications, New Y	York, 1997.
	Unit-I: Chapter 1: Sections $1.1 - 1.5$	
	Unit-II: Chapter 2: Sections $2.1 - 2.3$	
	Unit-III: Chapter 4: Sections $4.1 - 4.2$	
	Unit-IV: Chapter 5: Sections $5.1 - 5.3$	
	Unit-V: Chapter 6: Sections 6.1, 6.3	
Refe	rence Books	
1	F. Gantmacher, Lectures in Analytic Mechanics, MIR Publishers, Mosc	cow, 1975.
2	I. M. Gelfand and S. V. Fomin, Calculus of Variations, Prentice-Hall of	f India, New Delhi
	1963.	
3	S. L. Loney, An Elementary Treatise on Statics, Kalyani Publishers, Ne	ew Delhi,
	1979.	
Rela	ted Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
	http://math.ucr.edu/home/baez/classical/texfiles/2005/book/classical.pdf	
1	1	•
1 2	https://nptel.ac.in/courses/115/103/115103115/	

Mapping with	Progran	ıme Out	comes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	Μ	S	Μ	S	Μ	S	L	S	L
CO2	Μ	S	M	S	S	L	Μ	S	L	Μ
CO3	S	S	Μ	S	S	L	S	S	Μ	L
CO4	S	S	Μ	S	S	Μ	Μ	S	L	S
CO5	S	S	Μ	S	S	Μ	Μ	S	L	S

Cours	se code	ELECTIVE-V- FLUID DVNAMICS	L	Т	P	C
Semes	ster-III	ELECTIVE-V-FLUID DTNAMICS	3	0	0	3
Cours	se Objectives					
The m	ain objective	s of this course are to:				
1 Ał	ole to know th	ne fundamental concepts of fluids and its properties				
2. De	evelop the pro	blems solving skill in fluid dynamics.				
3. Kr	now the real-l	ife applications of fluid dynamics.				
Expec	cted Course (Outcomes:				
On th	ne successful	completion of the course, student will be able to:		T	71	
1	Recall the	basic concepts of velocity, density and curvilinear co-ordinate	S.	ľ	$\frac{1}{2}$	
2	Understand	a the concepts and equations of fluid dynamics		1 T	$\frac{32}{2}$	7 4
3	Analyze at	nd understand the concepts of the force experienced by a national flow		ľ	(2, 1	X 4
4	Analyze th	a approximate solutions of the Navier – Stokes equation.		ŀ	K4, I	K5
5	Analyze ar	and apply the appropriate method to solve integral equation of		L	(3 K	
3	Analyze al			Г	X.J., I.	(4
3	boundary l	ayer, Blasius equation and its series solution.		г	x ,,,,,,	(4
5 K1 -	boundary l Remember; l	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K	56 - Cre	ate	X , 1	(4
5 K1 -	Remember; I	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K	36 - Cre		x ,,,,,	
S K1 - Unit:	urrse Objectives: e main objectives of this course are to: Able to know the fundamental concepts of fluids and its properties. Develop the problems solving skill in fluid dynamics. Know the real-life applications of fluid dynamics. Pected Course Outcomes: In the successful completion of the course, student will be able to: Recall the basic concepts of velocity, density and curvilinear co-ordinates. Understand the concepts and equations of fluid dynamics Analyze and understand the concepts of the force experienced by a two- dimensional fixed body in a steady irrotational flow. Analyze the approximate solutions of the Navier – Stokes equation. Analyze and apply the appropriate method to solve integral equation of boundary layer, Blasius equation and its series solution. 1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create Init:1 Bernoulli's Equation and Equations of Motion 9 hutroductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filame luid Body – Density – Pressure. Differentiation with respect to the time – Kinematical and onditions – Rate of change of linear momentum – Equation of motion of an inviscid fluid. Init:2 Equations of Motion (Contd) 9 ho uler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady m elvin's theorem – vortex motion – Helmholtz equation. 9 ho		Durs	4 5		
S K1 - Unit: Intro	Remember; I	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; B Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes	X6 - Cre and Fil	eate 9 ho amer	ours nts –	4 - -
K1 - Unit: Intro Fluid	Remember; I :1 ductory Notic I Body – Den	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine	X6 - Cre and Fil matical	eate 9 ho amer and	ours nts – phy	sic
K1 - Unit : Intro Fluid cond	Remember; I :1 ductory Notic I Body – Den- itions – Rate	Aver, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv	and Fil matical	ate 9 ho amer and uid.	ours nts – phy	sic
K1 - Unit Intro Fluid cond	Remember; I :1 ductory Notic I Body – Den- itions – Rate	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons - Velocity - Stream Lines and Path Lines - Stream Tubes sity - Pressure. Differentiation with respect to the time - Kine of change of linear momentum - Equation of motion of an inv	and Fil matical iscid fl	eate 9 ho amer and uid.	ours nts – phy	sic
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K1 - Unit: Intro- Fluid cond Unit: Euler	itions – Rate	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) m Theorem – Conservative forces – Bernoulli's theorem in	and Fil matical iscid flu	9 ho amer and uid. 9 ho y mo	ours nts – phy ours	5
K1 - Unit Intro Fluid cond Unit Euler Kelv	itions – Rate	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons - Velocity - Stream Lines and Path Lines - Stream Tubes sity - Pressure. Differentiation with respect to the time - Kine of change of linear momentum - Equation of motion of an inv Equations of Motion (Contd) m Theorem - Conservative forces - Bernoulli's theorem in - vortex motion - Helmholtz equation.	and Fil matical iscid flu	9 ho amer and uid. 9 ho y mo	ours nts – phy urs otion	54
K1 - Unit : Intro Fluid cond: Unit : Euler Kelv:	Analyze al boundary l Remember; l :1 ductory Notio l Body – Den itions – Rate :2 r's momentum in's theorem	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) m Theorem – Conservative forces – Bernoulli's theorem in – vortex motion – Helmholtz equation.	and Fil matical iscid flu	and amer and uid. 9 ho y mo	purs nts – phy urs otion	5
K1 - Unit: Intro Fluid cond: Unit: Euler Kelv:	Analyze al boundary l Remember; l :1 ductory Notio l Body – Den itions – Rate :2 r's momentur in's theorem :3	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) m Theorem – Conservative forces – Bernoulli's theorem in – vortex motion – Helmholtz equation.	and Fil matical iscid flue	and amer and uid. 9 ho y mo	ours nts – phy urs	54
K1 - Unit: Intro- Fluid cond Unit: Kelv: Unit: Two	Analyze al boundary l Remember; l :1 ductory Notion l Body – Den- itions – Rate :2 r's momentum in's theorem :3 Dimension	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) m Theorem – Conservative forces – Bernoulli's theorem in – vortex motion – Helmholtz equation. Two-Dimensional Motion al Motion – Two Dimensional Functions – Complex	and Fil matical iscid fli n stead	9 ho amer and uid. 9 ho y mo	Durs nts – phy urs otion urs - ba	5 sic
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S K1 - Unit: Intro- Fluid cond Unit: Euler Kelv: Unit: Two singu (Mag	Analyze al boundary l Remember; l il ductory Notion l Body – Denalitions – Rate itions – Rate :2 r's momentum in's theorem in's theorem ilarities – sougnus effect)	Arrow of the series solution. Arrow of the series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) Two-Dimensional Motion al Motion – Two Dimensional Motion al Motion – Two Dimensional Functions – Complex arce – sink – Vortex – doublet – Circle theorem – Blasius The	and Fil matical iscid fl n stead	ate 9 ho amer and uid. 9 ho y mo hou al – Lift	Durs nts – phy urs otion Irs - ba t for	sic
S K1 - Unit: Intro- Fluid cond Unit: Euler Kelv: Unit: Two singu (Mag Unit:	Anaryze ar boundary l Remember; l itions – Rate itions – Rate :2 r's momentum in's theorem ilarities – sougnus effect) :4	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons - Velocity - Stream Lines and Path Lines - Stream Tubes sity - Pressure. Differentiation with respect to the time - Kine of change of linear momentum - Equation of motion of an inv Equations of Motion (Contd) m Theorem - Conservative forces - Bernoulli's theorem in - vortex motion - Helmholtz equation. Two-Dimensional Motion al Motion - Two Dimensional Functions - Complex urce - sink - Vortex - doublet - Circle theorem - Blasius Theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle theorem - Blasius Theorem - Sink - Vortex - Circle t	and Fil matical iscid fl iscid fl n stead	ate 9 ho amer and uid. 9 ho y mo 9 hou al - - Lift hou	ours nts – phy urs otion urs - ba t for rs	sic
S K1 - Unit: Intro- Fluid cond Unit: Euler Kelv: Unit: Two singu (Mag Unit: Visco	Analyze al boundary l Remember; l il ductory Notion l Body – Deminitions – Rate itions – Rate :2 r's momentum in's theorem ilarities – sou gnus effect) :4 ous flows – l	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons – Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) m Theorem – Conservative forces – Bernoulli's theorem in – vortex motion – Helmholtz equation. Image: Conservative forces – Bernoulli's theorem in – vortex motion – Helmholtz equation. Image: Dynamics of Real Fluids Navier-Stokes equations – Vorticity and circulation in a visc	6 - Cre and Fil matical iscid flu iscid flu n stead 9 Potenti eorem - 9 ous flu	ate 9 ho amer and uid. 9 ho y mo 9 hou al - Lift hou id -	ours ts – phy urs otion urs t for rs Stea	sic
K1 - Unit: Intro Fluid cond: Unit: Euler Kelv: Unit: Two singu (Mag Unit: Visco flow	Analyze al boundary l Remember; l :1 ductory Notional Body – Denalitions – Rate :2 r's momentum in's theorem :3 Dimensional ilarities – sougnus effect) :4 ous flows – I through an an	ayer, Blasius equation and its series solution. K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K Bernoulli's Equation and Equations of Motion ons - Velocity – Stream Lines and Path Lines – Stream Tubes sity – Pressure. Differentiation with respect to the time – Kine of change of linear momentum – Equation of motion of an inv Equations of Motion (Contd) m Theorem – Conservative forces – Bernoulli's theorem in – vortex motion – Helmholtz equation. Two-Dimensional Motion al Motion – Two Dimensional Functions – Complex urce – sink – Vortex – doublet – Circle theorem – Blasius The Dynamics of Real Fluids Navier-Stokes equations – Vorticity and circulation in a visc rebuiltion – Transon – Vorticity and circulation in a visc	A - Cre and Fil matical iscid flu iscid flu n stead Potenti eorem - 9 ous flu	ante 9 ho amer and uid. 9 ho y mo 9 hou al – Lift hou id –	ours nts – phy urs otion urs t for rs Stea	sic

Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness– flow parallel to semi infinite flat plate – Blasius equation and its solution in series.

							Total I	Lecture hours		45 hours
Те	ext Book(s)								·	
1	Units I an	d II: I	M. M	lilne Tho	omson, Th	neoreti	cal Hydr	o Dynamics, M	Iacmi	llan Company,
	5th Edition	n (1968	3).							
	Chapter I		:	Sectio	ons $1.0 - 1$	1.3., 3.	10, 3.30,	3.31, 3.40, 3.4	1.	
	Chapter I	II	:	Sectio	ons 3.42, 3	3.43, 3	.45, 3.52	, 3.53		
2	Units III,	IV and	d V: M	odern Fl	luid Dynar	mics V	/olume I	N. Curle and	H. J. I	Davies, D. Van
	Nostrand C	Compa	ny Lim	ited., Lo	ondon, 196	68.				
	Chapter III	[:	Sectio	ons 3.1-3	3.3, 3.5.1, 3	3.7.4,	3.7.5			
	Chapter V	:	Sectio	ons 5.2, 3	5.2.2, 5.2.	.3, 5.3	.1			
	Chapter V	[:	Sectio	ons 6.1.1	, 6.2, 6.2.3	3, 6.3.	1,			
Re	eference Bo	oks								
1	F. Chorlto	on, Te	xtbook	of Fluid	Dynamics	s, CBS	S Publish	ers, New Delh	i, 200	4.
2	A. J. Chori	in and	A. Mar	sden, A	Mathemat	tical II	ntroducti	on to Fluid Dy	namic	es, Springer-
	Verlag, N	lew Yo	ork, 199	93.						
Re	elated Onlir	ie Coi	ntents [MOOC	, SWAYA	AM, N	PTEL, V	Websites etc.]		
1	https://np	tel.ac.	in/cours	ses/112/	106/11210	06200/	/			
2	https://np	tel.ac.	in/cours	ses/112/	105/11210	05171/	/			

Mappin	g with Prog	ramme (Outcom	es							
COs	POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO
CO1		Μ	S	Μ	Μ	Μ	L	L	Μ	Μ	S
CO2		Μ	S	Μ	Μ	S	Μ	S	Μ	Μ	S
CO3		L	Μ	Μ	Μ	S	Μ	S	S	Μ	S
CO4		Μ	Μ	S	S	Μ	Μ	S	S	Μ	S
CO5		L	Μ	S	Μ	Μ	Μ	S	S	Μ	S

Course code	ELECTIVE-V- STOCHASTIC PROCESSES	L	Т	Р	C
Semester-III		3	0	0	3
Course Object	ives:				
1. Acquire 1 2. Understa 3. Develop	bjectives of this course are to: knowledge about the concept of Markov Chain and Queueing Synd the methods of Birth and Death queues with Finite and Infinite ability of Standard Brownian Motion.	ystem. ite Cap	acity.		
Expected Cou	rse Outcomes:				
On the succes	sful completion of the course, student will be able to:				
1 Acquire	adequate knowledge about Continuous Time Markov Chain and	d Queu	eing	K	1
2 Gain un Process.	derstanding on the Renewal Process, Cumulative Process and Se	emiMa	rkov	K	2, K
3 Apply d	ifferent methods and solve Birth and Death queues.			K	3
4 Examine	e the computations of M/G/1 and G/M/1 Queues and Network o	f Queu	es.	K	5
	e the idea of Brownian Motion and First Passage Times.			K4,	K5
5 Conclud	C				
5 Conclud K1 - Rememb	er; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate	; K6 -	Create)	
5 Conclud K1 - Rememb	er; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate	; K6 -	Create	2	
5 Conclud K1 - Rememb Unit:1 Continuous Ti Behavior.	ber; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate <u>Continuous-Time Markov Models</u> ime Markov Chain, Examples, Transient Analysis, Occupancy T	; K6 - (Create 9 hou Limiti	urs ing	
5 Conclud K1 - Rememb Unit:1 Continuous Ti Behavior.	ber; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate Continuous-Time Markov Models ime Markov Chain, Examples, Transient Analysis, Occupancy 7	; K6 - (Create 9 hou Limiti	urs ing	
5 Conclud K1 - Rememb Unit:1 Continuous T Behavior. Unit:2 Renewal Proc	eer; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate <u>Continuous-Time Markov Models</u> ime Markov Chain, Examples, Transient Analysis, Occupancy T <u>Generalized Markov Models</u> ess, Cumulative Process, Semi-Markov Process, Examples and	; K6 - (Create 9 hou Limiti 9 ho erm A	urs ing urs nalys	sis.
5 Conclud K1 - Rememb Unit:1 Continuous T Behavior. Unit:2 Renewal Proc Unit:3	er; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate <u>Continuous-Time Markov Models</u> ime Markov Chain, Examples, Transient Analysis, Occupancy T <u>Generalized Markov Models</u> ess, Cumulative Process, Semi-Markov Process, Examples and <u>Queueing Models</u>	; K6 - (Create 9 hor Limiti 9 hor 9 hor	e ing ours nalys	sis.
5 Conclud K1 - Rememb Unit:1 Continuous Ti Behavior. Unit:2 Renewal Proc Unit:3 Queueing Sy Capacity.	eer; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate Continuous-Time Markov Models ime Markov Chain, Examples, Transient Analysis, Occupancy 7 Generalized Markov Models Generalized Markov Models ess, Cumulative Process, Semi-Markov Process, Examples and Queueing Models stems, Single-Station Queues, Birth and Death queues with	; K6 - (Create 9 hor Limiti 9 hor erm A 9 hor e and	urs ing ours .nalys Infin	sis.
5 Conclud K1 - Rememb Unit:1 Continuous T Behavior. Unit:2 Renewal Proc Unit:3 Queueing Sy Capacity. Unit:4	er; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate Continuous-Time Markov Models ime Markov Chain, Examples, Transient Analysis, Occupancy T Generalized Markov Models ess, Cumulative Process, Semi-Markov Process, Examples and Queueing Models rstems, Single-Station Queues, Birth and Death queues with Queueing Models (Contd)	; K6 - (Create 9 hor Limiti 9 hor erm A 9 hor e and 9 hor 9 hor 9 hor	urs ing urs naly: Infin	sis.
5 Conclud K1 - Rememb Unit:1 Continuous T Behavior. Behavior. Unit:2 Renewal Proc Unit:3 Queueing Sy Capacity. Unit:4 M/G/1 and G/	er; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate Continuous-Time Markov Models ime Markov Chain, Examples, Transient Analysis, Occupancy T Generalized Markov Models ess, Cumulative Process, Semi-Markov Process, Examples and Queueing Models rstems, Single-Station Queues, Birth and Death queues with Queueing Models (Contd) M/1 Queues and Network of Queues.	; K6 - (Create 9 hot Limiti 9 hot erm A 9 hot e and 9 hot	urs ing ours nalys Infin Infin	sis.
5 Conclud K1 - Rememb Unit:1 Continuous T Behavior. Behavior. Unit:2 Renewal Proc Unit:3 Queueing Sy Capacity. Unit:4 M/G/1 and G/	er; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate Continuous-Time Markov Models ime Markov Chain, Examples, Transient Analysis, Occupancy T Generalized Markov Models ess, Cumulative Process, Semi-Markov Process, Examples and Queueing Models rstems, Single-Station Queues, Birth and Death queues with Queueing Models (Contd) M/1 Queues and Network of Queues. Brownian Motion	; K6 - (Create 9 hou Limiti 9 hou erm A 9 hou e and 9 hou	urs ing urs analys irs Infin	sis.

Sta	andard Broy	wnian Motion, Brownian Motion and First Passage Times.	
		Total Lecture hours	45 hours
Te	xt Book(s)		
1	V. G. Ku Springer,	lkarni, Introduction to Modelling and Analysis of Stochastic Syst 2011.	ems, Second Edition,
Re	ference Bo	ooks	
1	J. Medhi,	Stochastic Processes, New Age, 2009.	
2	S. M. Ros	s, Stochastic Processes, Wiley Series in Probability and Statistics,	1996.
Re	lated Onli	ne Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://npte	el.ac.in/courses/111/102/111102014/#	
2	https://np	otel.ac.in/courses/111/102/111102014/#	
3	https://di	gitalcommons.usu.edu/cgi/viewcontent.cgi?article=2145&context	t=gradreports

Mappir	ng with Prog	ramme (Outcome	es							
COs	POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO
CO1		Μ	S	Μ	Μ	Μ	L	L	Μ	Μ	S
CO2		Μ	S	Μ	Μ	S	Μ	S	Μ	Μ	S
CO3		L	Μ	Μ	Μ	S	Μ	S	S	Μ	S
CO4		Μ	Μ	S	S	Μ	Μ	S	S	Μ	S
CO5		L	Μ	S	Μ	Μ	Μ	S	S	Μ	S

Course co	ode		Skill Enhancement Course- NME 1: MATHEMATICAL DOCUMENTATION USING LATEX	L	Т	Р	C			
Semester	-III			3	0	0				
Course O	bjectives:									
The mair	n objective	s of this co	urse are to:							
1. Under	stand richn	less of Late	ex rather than using M.S word for documentation.							
2. Profici	ient in doc	umentation	using mathematical symbols, graphs and tables.							
Expected	Course O	utcomes:								
On the su	uccessful c	ompletion	of the course, student will be able to:							
1	Underst	and basic c	concepts of Text formatting and LaTex file			K	2			
2	Demons	strating con	nmand names and arguments, Special characters.			K.	3			
3	Apply th	he comman	ommands to create document layout and displayed output							
4			K	6						
5	Apply L	aTex com	mands to mathematical formulae			K.	3			
K1 - Rer	nember; K	2 - Underst	tand; K3 - Apply; K4 - Analyze; K5 - Evaluate; I	X6 - Cr	eate					
Unit:1			Introduction	91	10U1	S				
LaTex 26	e, Basics of	f a LaTex f	ile.							
Unit:2			Commands and Environments	91	hou	rs				
Comman Spaces a The date	nd names an nd carriage , Exercises	nd argumer e returns, Q	nts, Environments, Declarations, Lengths, Special puotation marks, Hyphens and dashes, Printing co	Charac mmand	ters cha	_ racte	ers,			
Unit:3		Docur	ment Layout and Organization	91	loui	S				
Docume Printing	ocument class, Page style, Parts of the document, Table of contents – Automatic entries, rinting the table of contents, Fine-Tuning text – Line breaking, Page breaking.									
Unit:4			Displayed Text	91	loui	S				
Displaye indenting	d Text – C g, Lists. Ta	hanging fo bles, Printi	nt – Emphasis, Choice of font size, Font attribute ng literal text, Footnotes and marginal notes.	s, Cente	ering	g and				
			Mathematical Formulae	91	10111	s				
Unit:5				<i>,</i> 1		~				

		Total Lecture ho	ours	45 hours
Text	t Book(s)			
1	Helmut Kopka	and Patrick W. Daly, A Guide to LATEX, T	hird Edition, A	ddison –
	Wesley, Londo	n,1999.		
	Unit I : C	Chapter 1 : Sections : 1.1-1.3, 1.4.1, 1.5.		
	Unit II :	Chapter 2 : Sections : 2.1-2.4, 2.5.1-2.5.4, 2.5	5.9, 2.7.	
	Unit III :	Chapter 3 : Sections : 3.1-3.3, 3.4.1, 3.4.2, 3	.5.2, 3.5.5, Cha	pter 4 : 4.1.1-4.1.3
	4.2, 4.3			
	Unit IV :	Chapter 4 : Sections : 4.8-4.10.		
	Unit V :	Chapter 5: Sections : 5.1, 5.2, 5.31, 5.3.8, 5.4	4, 5.4.1 – 5.4.8,	5.5.1, 5.5.2.
Refe	erence Books			
1	Velusamy	Kavitha and Mani Mallikarjunan, Fundamenta	als of Latex for	
	Mathemati	cians, Physicists and Engineers, LAP LAMB	ERT Academy	Publishing,
Dala		A		
	https://www.	itents [WOOC, SWATAM, NPTEL, Webs	sites etc.	
1	nttps://wv	vw.youtube.com/watch/v=Q4FozDTRE_4		
2	I https://ww	w volume $com/watch/v=DvDU1mealw0$		

Mapping with	Progran	nme Out	comes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	Μ	L	Μ	Μ	Μ	L	L	Μ	Μ
CO2	Μ	L	L	Μ	Μ	Μ	L	L	Μ	Μ
CO3	L	Μ	L	Μ	Μ	S	L	S	S	Μ
CO4	Μ	L	L	Μ	Μ	Μ	L	L	Μ	Μ
CO5	L	Μ	Μ	Μ	Μ	S	L	S	S	Μ

Course code		Core Paper XI:FUNCTIONAL ANALYSIS	L	T	Р	C
Semester-IV			6	0	0	5
Course Objectiv	es:					
The main objecti	ves of this co	ourse are to:				
1. To get an ove conjugate sp	rview of nor ace ,bounde	rmed spaces and familiarize on Banach space, Hilbered linear operators and spectral theory.	rt space	e,		
Expected Cours	Outcomes					
On the successf	1 completio	on of the course, student will be able to:				
1 Fam line	iliarize with r space	the concepts of normed linear spaces and operators	on nor	med	K	1
2 Den Ban	onstrate an ach spaces, a	understanding of the concepts of Hilbert spaces and and their role in mathematics			K2	2
3 App	ly the theore	ems.			K?	3
4 Obta	in Orthogor	nal complements, Orthonormal sets and conjugate sp	ace.		K4	4
5 Und oper	erstand the c ators, isome spectrum of	concepts of linear operators, self adjoint, unitary etric isomorphism on Hilbert spaces ,Determinants an operator, Banach algebra.			K2	2
K1 - Remember	; K2 - Unde	erstand; K3 - Apply; K4 - Analyze; K5 - Evaluate; F	K6 - Cre	eate		
Unit•1		Banach	18	hou	irs	
Banach spaces -	- The definit	ion and some examples – Continuous linear transfor	rmation	is –		
The Hahn-Bana mapping theore	ch theorem - m - Closed (-Dual spaces- The natural imbedding of N in N** - Graph theorem.	The op	en		
Unit:2		Hilbert	18	3 hou	ırs	
The conjugate of and some simple sequences – Ma	f an operato e properties ximal Ortho	r – Uniform boundedness Principal - Hilbert spaces – Orthogonal complements and complements - Orthonormal sets.	– The d nonorma	defir al se	nitior ts an	n Id
Unit:3		Hilbert spaces (Contd)	18	3 hoi	urs	
The Conjugate operator – Self	space H* - I adjoint oper	Representation of functional on Hilbert spaces - The rators – Normal and unitary operators – Projections.	adjoint	of a	n	
Unit:4		Finite-Dimensional Spectral Theory	18	3 ho	urs	
Matrices – Dete	rminants and	d the spectrum of bounded operator – The spectral th	heorem	•		
Ilnit.5		General Preliminaries on Banach Algebras	18	3 ho	urs	
Umt.s	nd some exa	amples of Banach algebra – Regular and singular ele	ments			
The definition a Topological div	isors of zero	• - The spectrum - The formula for the spectral radiu	18.			
The definition <i>a</i> Topological div	isors of zero	• – The spectrum – The formula for the spectral radio	15.			

Text	Book(s)
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Text D	JOK(S)						
1	G. F. Simmons, Int	roduction to Topology and Modern Analysis, McGraw-Hill					
	Book Company, Lo	ondon, 1963.					
	UnitI:	Sections: 46–50.					
	UnitII:	Sections: 51–54.					
	UnitIII:	Sections: 55–59.					
	UnitIV:	Sections: 60–63.					
	UnitV:	Sections: 64–68.					
Referen	nce Books						
1	C. Goffman and G. Pedrick, A First Course in Functional Analysis, Prentice Hall of India, New Deli, 1987.						
2	G. Bachman and L.	G. Bachman and L. Narici, Functional Analysis, Academic Press, New York, 1966.					
3	L. A. Lusternik and	V.J. Sobolev, Elements of Functional Analysis, Hindustan					
	Publishing Corpora	tion, New Delhi, 1971.					
Related	l Online Contents [N	MOOC, SWAYAM, NPTEL, Websites etc.]					
1	https://nptel.ac.in/	courses/111/105/111105037/					
2	https://ocw.mit.edu	/courses/mathematics/18-102-introduction-to-functional-analysis-					
	spring- 2009/lectur	e-notes/					

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	Μ	Μ	Μ	S	L	Μ	S
CO2	S	S	Μ	Μ	L	S	S	Μ	S	Μ
CO3	Μ	Μ	L	S	S	S	S	S	Μ	S
CO4	S	Μ	S	L	L	S	S	S	Μ	S
CO5	S	S	S	L	Μ	S	S	Μ	S	Μ

Course	Core Pap	er XII:DIFFERENTIAL GEOMETR	RY L	Т	Р	С
Semeste	-IV		6	0	0	4
Course O	ojectives					I
The main	objectives of this course ar	e to:				
1. Ga	n knowledge about curves a	nd its characterizations.				
2. Ge	sufficient knowledge on El	ementary Theory of surfaces.				
3. Mal	e the students to familiarize	with space curves and curves on surface	ces.			
E	Comme Orate and a					
On the	uccessful completion of the	course, student will be able to:				
1 D	fine and understand basic d	lefinitions of the theory of curves.			K1	
2 Ir	erpret the notions of surfac	e of revolution and direction coefficient	zs.		K2	
3 A	alyze the elements of Anal	ytic representation.			K4	
4 A	quire knowledge on first fu	indamental form and second fundament	al form	l .	K4	
5 E	plain Meusnier's theorem a	and Euler's Theorem on elementary theorem	ory of		K3	
K1 - Re	nember; K2 - Understand;	K3 - Apply; K4 - Analyze; K5 - Evalua	ate; K6	- C	reat	te
Unit:1	Represe	ntation and Theory		18 F	noui	rs
	of S	Space Curves				
Represe	ntation and theory of Space	Curves introduction-Representation of	space of	curv	es-	
Unique	parametric representation of	f a space curve- Arc length - tangent and	d oscul	atin	g pla	ane
- princi	al normal and binormal - cu	urvature and torsion - contact between c	urves a	and s	surfa	ace
- oscula	ing circle and osculating sp	here - locus of centres of spherical curv	vature.			
Unit:2	Evolutes of a P	Plane and Space Curve		18 ł	loui	rs
Evolutes	of a Plane and Space Curve	introduction- Tangent surfaces - Involu	ites			
and evol	tesBetrand curves - Spheric	cal indicatrix - Intrinsic equations of spa	ice			
curves –	Fundamental existence theo	rem for space curves - Helices.				
Unit:3	The First Fundame	ental Form and Local Intrinsic		18 F	0111	rs
0	Propert	ies of a Surface				
The Firs	Fundamental Form and	Local Intrinsic Properties of a	Surface	e		
ntroducti	n- Definition of a surface -	Nature of points on a surface - Represe	entatio	1		
of a surfa	e - Curves on surfaces - Ta	angent plane and surface normal - The	genera	1		
Direction	revolution – Helicoids - M	letric on a surface - The first fundament	tal forn	1		
Directio	coefficients on a surface.					
Unit:4	Far	nilies of curves	18	ho	urs	
Families	of curves introduction Ort	thogonal trajectories - Double family of	f curve	S		
 Isome 	ric correspondence - Intr	insic properties - Geodesics on a	surface	:		
	1 - 1 + 1 - 1 + 1 + 1 + 1 + 1 + 1 + 1 +		TIONE			
Geodesic	s and their differential e	Normal property of acadesia Diff		-		
Geodesic	s and their differential e s on surface of revolution	- Normal property of geodesics - Diff	erentia	- 1		
Geodesic Geodesic equation	s and their differential e s on surface of revolution of geodesics using normal	- Normal property of geodesics - Diff property.	erentia	1		
Geodesic Geodesic equation	s and their differential e s on surface of revolution of geodesics using normal	- Normal property of geodesics - Diff property.	erentia	1		
Geodesic	s and their differential e s on surface of revolution of geodesics using normal	- Normal property of geodesics - Diff property.	ferentia	1		

Unit:5 Existence Theorems 18 hours Existence theorems proof- Geodesic parallels - Geodesic polar coordinates – Geodesic curvature - Gauss-bonnet theorem-Meusnieu''s theorem-Gaussian curvature Euler''s theorem-Duplin''s indicarix-Surface of revolution conjugate system-Asymmetric lines-isometric lines

Total Lecture hours

90 hours

Text Book(s)

1

D. Somasundaram, "Differential Geometry: A first course", Narosa Publishing House, New - Delhi, India, 2005. Unit I: Sections 1.2-1.7, 1.10-1.12 Unit II: Sections 1.13-1.18 Unit III: Sections 2.2-2.10 Unit IV: Sections 2.11-2.15, 3.2-3.6 Unit V: Sections 3.7-3.12

R	eference Books
1	Differential Geometry by T.J. Willmore, Oxford University Press (Seventeenth
	Impression - 2002).
2	Dirk J. Struik: "Lectures on Classical Differential Geometry" (second
	edition), Addison Wesley PublishingCompany.
-	
3	J. N. Sharma & A. R. Vasistha, "Differential Geormetry", KedarNath Ram
	Nath, Meerut, 1998.
R	elated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-ma07/
2	https://www.youtube.com/watch?v=tKnBj7B2PSg
3	http://pages.uoregon.edu/koch/math433/Final.pdf

Mappi	ng with	Program	me Out	tcomes						
C O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	Μ	Μ	S	S	L	S	S	L	Μ
CO2	Μ	S	Μ	Μ	Μ	Μ	Μ	L	Μ	S
CO3	S	Μ	S	Μ	L	Μ	S	Μ	S	L
CO4	Μ	S	L	S	S	L	Μ	S	Μ	S
CO5	Μ	S	Μ	S	Μ	Μ	S	Μ	S	Μ

Course cod	e	Core P	aper XI	II: Project		L	Т	Р	C
Semester-I	V					10	0	0	7
Course Obj	ectives:							1	<u> </u>
The main ob	jectives of	f this course are to:	:						
1. To stu	idy the bas	sic concepts related	l to the H	Project work.					
2.To kno	ow the resp	pective research fie	elds						
3.To know th	e concept	of writing a dissert	tation in	an effectivew	ay.				
Expected C	ourse Out	tcomes:							
On the suce	cessful cor	npletion of the cou	irse, stud	lent will be at	ole to:				
1 Applvii	ng the relat	tive notions in the	respectiv	ve areas and f	nding the			К	3
results			respectiv		inding the				
2 Analyz	zing result	s with the existing	results.					K	4
3 Interp	reting the r	esults with suitable	e examp	les.				K	4
4 Acquir	e knowled	lge in their area of	interest.					K	2
5 Promot	e techniqu	es of research						K	5
K1 - Reme	mber; K2	- Understand; K3	- Apply:	K4 - Analyze	e: K5 - Eva	luate: K	6 - C	reate	
	,	,	11 57	J	,	,			
Title of the	Course	PROI	FCT W		OCF-CC				
		IROJ			TOCE-CC				
Paper Num	Coro								
Category	Cole	Year	11		/		se		
		Semester							
Instruction	al Hours	Lecture		utorial	Lab Prac	ctice	Tota	l	
per week		10					10		

Course code		ELECTIVE-VI-	-: MATHEMATICAL PYTH	ION	L	T	Р	С
Semester-IV					2	0	0	3
Course Obje	ctives:							
The main obje	ectives	f this course are to:						
1. To in	ntroduc	the fundamentals of Pytho	on Programming.					
2. To te	each abo	it the concept of Functions	inPython.					
3. To m	npart th	knowledge of Lists, Tuple	es, Files and Directories					
Expected Co	urse O	tcomes:						
On the succe	essful co	mpletion of the course, stud	dent will be able to:					
1 Re in	emembo Python	ring the concept of operator programming.	rs, data types, Loops and contr	ol state	ments	K	1	
2 U1	ndersta	ding the concepts of Input /	Output operations in file.			K	2	
3 Aj	pplying	he concept of functions and	d exception handling			K	3	
4 A1	nalyzin	the structures of list, tuples	s and maintaining dictionaries.			K	4	
5 Apj	plying (e concept of User defined e	exceptions			K	3	
K1 - Remen	nber; K	- Understand; K3 - Apply;	K4 - Analyze; K5 - Evaluate	; K6 - C	reate			
Unit:1		Introductio	on to Python		6 hou	rs		
Introduction	- Pvth	n Overview - Getting Sta	arted with Python –	Commer	nts - Pvt	hon		
- String Oper - Iteration - Y	ations - While S	Boolean Expressions - Con atement - Input from Keyb	trol Statements oard.				L	
Unit:2		Funct	ions		6 hours			
Built-in funct Function Call Python Script	tions - s - The s.	Composition of functions - eturn Statement - Python R	- User defined functions - Pa Recursive Function - The Anor	arameten nymous	rs and A Functio	Argu ns –	men Writ	ts - ting
Unit:3		Strings a	and Lists	6	hours			
Strings: Comp Escape Chara Elements - L Methods.	pound l acters - Lists ar	ata Type - Len Function - String Formatting Operato Mutable - Deleting Elen	String Slices - Strings are Im or - String Formatting Function nents from List- Built-in lis	mutable ons. Va t Opera	- String llues an tors - 1	g Tra d Ao Built	ivers ccess -in	al - ing List
Unit:4		Diction	aries	6	hours			
Dictionaries: elements from methods.	Creatin n Dictio	a Dictionary - Accessing hary - Properties of Diction	values in a Dictionary - Upd ary keys - Operations in Dicti	lating D ionary -	ictionar Built- i	y - I n Di	Delet ction	ting ary
Unit.5		File		6	houre			
Files: Text fil from a file - F * - Self Study	les: Op Renamin and qu	ning a file - Closing a file g a file - Deleting a file - Fi stions for examinations ma	- The file object attributes - iles related methods. any be taken from the self study	Writing portion	to a fi s also.	le - Ì	Read	ling

	Total Lecture hours 30 hours
Tex	Book(s)
1	E. Balagurusamy, Problem Solving and Python Programming, First Edition, 2017, McGraw-Hill Education (India) Pvt. Ltd, Chennai.
Refe	rence Books
1	1. Ashok Namdev Kamthane, Amit Ashok Kamthane, Programming and Problem Solving with Python, McGraw-Hill, First Edition, 2017.
2	 Martin Jones, Python for Complete Beginners, Create space Independent Publisher, First Edition, 2015.
3	3. S.A.Pv. Kulkarni, Problem Solving and Python Programming, Yes Dee

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	Μ	Μ	Μ	S	L	Μ	S
CO2	S	S	Μ	Μ	L	S	S	Μ	S	Μ
CO3	Μ	Μ	L	S	S	S	S	S	Μ	S
CO4	S	Μ	S	L	L	S	S	S	Μ	S
CO5	S	S	S	L	Μ	S	S	Μ	S	Μ

Course code	Core Practical-I: Programming in Python - Practical	L	Т	Р	С
Semester-IV		0	0	2	2

Course Objectives:

The main objectives of this course are to:

- 1. To gain knowledge about the concepts of Python programming.
- 2. To solve algebraic and non-linear ordinary differential equations using Python programs.
- 3. To enhance the students to develop the program writing skills for mathematical problems.

K2 K3

K4

K5

K6

Expected Course Outcomes:						
On the su	ccessful completion of the course, student will be able to:					
1	Understand the concept of Python programming					
2	Utilizing Python program for finding the Numerical solutions of					
	Algebraic and Transcendental Equations.					
3	Analyzing the GCD, interpolation values and File management using					
	Python programs					
4	Implement basic operators and function concepts.					
5	Applying, compiling and debugging programs with the help of Python					

LIST OF PRACTICAL PROGRAMS

- 1. Program to determine the Greatest Common Divisor (GCD) of any two integers.
- 2. Program to accept two complex numbers and find their sum.
- 3. Program to display the Pascal's triangle.
- 4. Program to find the number of instances of different digits in a given number.
- 5. Program to find the number of vowels and consonants in a text string.
- 6. Program to find the numerical solution of algebraic and transcendental equations by using
 - (i) Bisection Method.
 - (ii) Newton Raphson Method.
- 7. Program to solve an ordinary differential equation by using Fourth order Runge-Kutta Method.
- 8. Program to find the interpolation value using Lagrange's method.
- 9. Program to solve the simultaneous equations by
 - (i) Gauss Elimination Method
 - (ii) Gauss Seidel Method
- 10. Program to demonstrate File Input and Output operations.

COs/POs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	Μ	S	S	S	S	М	S
CO3	S	S	S	S	S	S	Μ	S	S	S
CO4	S	S	Μ	S	S	S	S	Μ	S	S
CO5	S	S	S	S	Μ	S	S	S	Μ	S

S- Strong = 3, M-Medium= 2, L-Low = 1

es: estudents are on posed to: oncepts of Probability theory, The Central limit theorem.		I	P	С
es: students are on posed to: oncepts of Probability theory, The Central limit theorem.	4	0	0	
students are on posed to: oncepts of Probability theory, The Central limit theorem.		Ů	Ŭ	
oncepts of Probability theory. The Central limit theorem.				
ts of Geometric Brownian motion Option pricing				
ives of Blackschole formula and its applications				
t of call option on Dividend paying securities, estimating the volatili	tv			
	c)			
ons of Arbitrage pricing, the portfolio selection problem.				
Outcomes:				
l completion of the course, student will be able to:				
rstand the basic concepts of Financial Mathematics.		K	2	
rstand and prove theorems.		K	2, K	5
rstand the method to solve the problems by applying principles and of Financial Mathematics		K3, K5		
K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - C	Create			
Probability and Event	2 hom	rs		
Geometric Brownian	2.1 - 2.	4)	.1	
Motion and Pricing	Models urn Co Arbitra	Bro ontin ge. S	own iuou Secti	ia sl
Motion and Pricing nian Motion-Geometric Brownian Motion as a limit of Simple 7 roblems- Interest Rates – Present Value Analysis- Rate of Ret Rates-An example of option Pricing –Other example of Pricing via 4, 5.1, 5.2)		rs		
Motion and Pricing nian Motion-Geometric Brownian Motion as a limit of Simple 1 roblems- Interest Rates – Present Value Analysis- Rate of Ret Rates-An example of option Pricing –Other example of Pricing via 4, 5.1, 5.2) Black Scholes Formula and Derivation	2 hou	ne B	lack la-	
Motion and Pricing nian Motion-Geometric Brownian Motion as a limit of Simple 1 roblems- Interest Rates – Present Value Analysis- Rate of Ret Rates-An example of option Pricing –Other example of Pricing via 4, 5.1, 5.2) Black Scholes Formula and Derivation 1 prem-The Multi period Binomial Model-Proof of the Arbitrage Theoremetries of the Black –Sholes Option Cost-Derivation of Black Scholes Section (6.1 - 6.3, 7.2, 7.3, 7.5)	l 2 hou rem-Tl oles Fo	rmu		
Motion and Pricing nian Motion-Geometric Brownian Motion as a limit of Simple 1 roblems- Interest Rates – Present Value Analysis- Rate of Ret Rates-An example of option Pricing –Other example of Pricing via 4, 5.1, 5.2) Black Scholes Formula and Derivation 1 prem-The Multi period Binomial Model-Proof of the Arbitrage Theoroperties of the Black –Sholes Option Cost-Derivation of Black Scholes Section (6.1 - 6.3, 7.2, 7.3, 7.5) Volatility Parameter 1	l 2 hour orem-Tl oles Fo 2 hour	s		
niar rob Rate 4, 5	Black Scholes Formula and Derivation 1 m-The Multi period Binomial Model-Proof of the Arbitrage Theorem States States Option Cost Derivation of Pleak Sch		tion (6.1 - 6.3, 7.2, 7.3, 7.5)	tion (6.1 - 6.3, 7.2, 7.3, 7.5)

Unit:5	5 Period and	d Geometric Brownian Motion	12 hours
Valuin	ng by Expected Utility-Limitation	on of Arbitrage pricing-Valuing Investments b	У
Expect	ted Utility-The portfolio selecti	on problem—Value at risk and conditional val	ue at risk
The ca	pital assets pricing model-Mea	n Variances analysis of risk-Neutral priced Ca	11
option	sRates of return-Single Period a	and Geometric Brownian Motion Simple Pro	blems.
Section	n (9.1 - 9.7)		
		Total Lastura hours	60 hours
		I OTAL LECTURE HOURS	
Text H	Book(s)		
Text E	Book(s) Sheldon M.Ross, An Ele	mentary Introduction to Mathematical	
Text E 1	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Cam	mentary Introduction to Mathematical abridge University press, 2005.	
Text F	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Carr	mentary Introduction to Mathematical abridge University press, 2005.	
Text E	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Cam ence Books	mentary Introduction to Mathematical abridge University press, 2005.	
Text F 1 Refere	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Carr ence Books S.M.Ross, A First Course	mentary Introduction to Mathematical abridge University press, 2005.	INJ, 2002.
Text E 1 Reference 1	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Cam ence Books S.M.Ross, A First Course	mentary Introduction to Mathematical abridge University press, 2005.	INJ, 2002.
Text F 1 Refere 1 2	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Cam ence Books S.M.Ross, A First Course J.Cox M.Rubinstein, Opti	mentary Introduction to Mathematical abridge University press, 2005.	INJ, 2002. 1985.
Text F 1 Refere 1 2 3	Book(s) Sheldon M.Ross, An Ele Finance,2nd Edition, Cam ence Books S.M.Ross, A First Course J.Cox M.Rubinstein, Opti J.E.Ingersill, Theory of Fi	mentary Introduction to Mathematical abridge University press, 2005. e in Probability, Englewood cliffs Prentice Hall ion Market, Englewood cliffs Prentice HallNJ, inancial decision Making, Lanjarn MD Rower	INJ, 2002. 1985. man of Little

Mapping with	Progran	nme Out	comes							
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	Μ	Μ	Μ	S	L	Μ	S
CO2	S	S	Μ	Μ	L	S	S	Μ	S	Μ
CO3	Μ	Μ	L	S	S	S	S	S	Μ	S
CO4	S	Μ	S	L	L	S	S	S	Μ	S
CO5	S	S	S	L	Μ	S	S	Μ	S	Μ

Course code	Professional Competency Skill Enhancement Course- III	L	Τ	Р	P C 0 4	
Semester-IV	Training for Competitive Examinations - Mathematics for NET / UGC –CSIR / SET / TRB Competitive Examinations and General Studies for UPSC/ TNPSC	4	0	0		
Mathen	natics for NET / UGC –CSIR / SET / TRB Competitive Exami	ination	IS	<u> </u>	<u>.</u>	
Course Objectives:						
In this course, the stuc	lents are on posed to:					
1. The basic conc	epts of differential equations.					
2. The concepts of	of graph theory and their applications.					
3. Solve the CK ϵ	equation problems in complex analysis.					
4. Solve the same	ling problems.					
				<u> </u>		
Expected Course On	itcomes:					
On the successful co	ompletion of the course, student will be able to:		17			
1 To understa	1 To understand the basic concepts of differential and graph theory.					
2 To understa	To understand and prove theorems.				K2, K5	
3 To understa	nd the method to solve the problems by applying principles and		K.	3, K	5	
concepts of	complex, differential areas.					
K1 - Remember; K2	2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - C	Create				
IInit.1	I incor Algobro	6 hour				
Theory of sets - Vec	tor space – Inner product spaces – Theory of matrices.					
Unit-2 ComplexAnalysis 6 hours						

Introduction to the concept of analytic function - limits and continuity - analytic functions - Maclaurin's series - Analytic functions - Cauchy's theorem - Cauchy's integral formula - higher derivatives - Local properties of Analytic functions and removable singularities- Taylor's theorem - Zeros and Poles

Unit:3	Graph Theory	6 hours
Graphs and subgraphs	: Graphs and simple graphs - Graph isomorphism - Incide	ence and adjacency
matrices – Subgraphs	- Vertex degrees - Path and cycles - Applications : path	problem - Trees - Cut
edges and bonds - Cut	t vertices - Connectivity - Blocks - Euler tours and Ham	ilton cycles- Matchings.

Unit:4	Differential Equations	6 hours
Types of differentia	l equation -order and degree- variable separable- linea	ar differential equation –
integrating factor- lin	hear equation of 2^{nd} order with constant coefficient – Ex	act differential equation

Unit:5		Statistics	6 hours		
Probabil	ity Discrete	- sample space, events - their union - intersection - Proba	bility in		
continuo	ous probabilit	ty space - conditional probability and independence – Bay	ye's theorem -		
probabil	ity functions	- Probability density functions - Distribution function.			
		Total Loatura hours	30 hours		
		Total Lecture nours	50 110015		
T D	- I -(-)				
1 ext B0	OK(S)	NTA CSID LICC NET/SET Mathematical Sciences			
1	Ai main,	NTA CSIK UGC, NET/SET, Mathematical Sciences.			
		General Studies for UPSC/ TNPSC			
Course C	Objectives:				
1 this cout	rse, the stude	ents are on posed to:			
1. 110		spis of general mathematics.			
F 4 1	<u> </u>	4			
On the s	UCCESSFul COL	tcomes:			
$\frac{1}{1}$	To understan	ad the basic concepts of statistics	К2		
1	10 understun	a the busic concepts of statistics	112		
2 '	To understan	nd and solve the probability problems.	K2, K		
K1 - Rei	member; K2	- Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;	K6 - Create		
	T				
Unit:1		Measure of central tendency	6 hours		
Aritnmet	ic mean - me	edian - mode - geometric mean- Harmonic mean			
Unit:2		Probability	6 hours		
Probabilit	y - Addition	, Multiplication and Baye's Theorems and their application)n.		
	-				
Unit:3		Distribution	6 hours		
robability	distribution	s – Marginal and conditional distributions – Expectations	– Moments and		
imulants	generating n	unctions.			
Unit:4		Continuous Distribution	6 hours		
robabilit	y distributio	ns – Binomial, Poisson, Continuous distributions norma	l.		
Range - Quartaile - Mean Deviation Total Lecture hours 30 ho Text Book(s) 1 B. L. Aggarwal, Basic statistics for competitive examinations.	Unit:5		Measure o	of dispersion	6 hours
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Total Lecture hours 30 ho 'ext Book(s) B. L. Aggarwal, Basic statistics for competitive examinations.	ange - (Quartaile	- Mean Deviation - standa	rd Deviation	
I B. L. Aggarwal, Basic statistics for competitive examinations.				Total Lecture hou	rs 30 hours
B. L. Aggarwal, Basic statistics for competitive examinations.	Fext Boo	k(s)			
	1	B. L. A	ggarwal, Basic statistics for	competitive examinations.	