M.Sc., MATHEMATICS

Syllabus

Program Code: PMT

2021-2022 onwards



MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS) Re-accredited with "A" Grade by NAAC PASUMALAI, MADURAI – 625 004

Eligibility condition for admission

For admission to Post Graduate Programmers (P.G) a candidate should have passed the 3years degree course (under 10 + 2 + 3 pattern) (B.Sc Mathematics and B.Sc Mathematics with CA) recognized by the university as equivalent there to.

Duration

Two years. Each year consists of 2 semesters. The duration of a semester is 90 working days.

Attendance

75% of the classes in each semester shortage of attendance can be condoned as per existing university rules.

Evaluation procedure:

A mark Statement with $CGPA = \sum(MarksXcredits)$ $\sum(Credits)$ Where the summations are over all paper appeared up to the current semester. Examinations: 3 hours duration. Total marks 100 for all papers External Internal ratio 75:25 with 2 Internal tests.

Subjects of Study

The courses offered under the PG programs belong to the following categories:

- 1. Core Subjects
- 2. Electives
- 3. Non Major Electives (NME)

Pattern of the question paper for the Continuous Internal Assessment Note: Duration – 1 hour 30 minutes

The components for continuous internal assessment are:	
Part –A	
Four multiple choice questions (answer all)	4 x01= 04 Marks
Part –B	
Three short answers questions (answer all)	3 x02= 06 Marks
Part –C	
Two questions ('either or 'type)	2 x 05=10 Marks
Part –D	
Two questions out of three	2 x 10 = 20 Marks
Total	40 Marks

The scheme of Examinations:

The components for continuous internal assessment are:

(40 Marks of two continuous internal assessments will be converted to 15 marks)

Two tests and their average	15 marks
Seminar /Group discussion	5 marks
Assignment	5 marks
Total	25 Marks

Pattern of the question paper for the Summative Exami	nations:	
Note: Duration- 3 hours		
Part –A		
Ten multiple choice questions	10 x01	= 10 Marks
No Unit shall be omitted: not more than two questions from	n each unit.)	
Part –B		
Short answer questions (one question from each unit)	5 x02	= 10 Marks
Part –C		
Five Paragraph questions ('either or 'type)	5 x 05	= 25 Marks
(One question from each Unit)		
Part –D		
Three Essay questions out of five	3 x 10	=30 Marks
(One question from each Unit)		
Total		75 Marks

Minimum Marks for a Pass

50% of the aggregate (Internal +Summative Examinations).

No separate pass minimum for the Internal Examinations.

34 marks out of 75 is the pass minimum for the Summative Examinations.

VISION

To empower the students so as to face the competitive world and make them fit for the MNCs according to their necessity and requirement

MISSION

- > To maintain the standard of teaching in various areas of Pure and Applied Mathematics
- To provide an excellent learning environment with theoretical and practical knowledge where students can explore mathematical concepts.
- > To mold the students to become a competent users of Mathematics and its applications.
- > To instill the spirit of research through innovative teaching and research facilities.
- > To qualify the students to meet the industry expectations.

The 12 Graduate Attributes*:

- 1. (KB) A knowledge base for engineering: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.
- 2. (PA) Problem analysis: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions
- 3. (Inv.) Investigation: An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data and synthesis of information in order to reach valid conclusions.
- 4. (Des.) Design: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
- 5. (Tools) Use of engineering tools: An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.
- 6. (Team) Individual and teamwork: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
- 7. (Comm.) Communication skills: An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

- 8. (Prof.) Professionalism: An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
- 9. (Impacts) Impact of engineering on society and the environment: An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
- 10. (Ethics) Ethics and equity: An ability to apply professional ethics, accountability, and equity.
- 11. (Econ.) Economics and project management: An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.
- 12. (LL) Life-long learning: An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge

WA	Graduate Attributes	Caption as
1	Demonstrated competence in university level mathematics, natural	A knowledge
	sciences, engineering fundamentals, and specialized engineering	base for
	knowledge appropriate to the program.	engineering
2	An ability to use appropriate knowledge and skills to identify,	Problem
	formulate, analyze, and solve complex engineering problems in order to	analysis
	reach substantiated conclusions	
3	An ability to conduct investigations of complex problems by methods	
	that include appropriate experiments, analysis and interpretation of data	Investigation
	and synthesis of information in order to reach valid conclusions.	
7	An ability to communicate complex engineering concepts within the	Communicat
	profession and with society at large. Such ability includes reading,	ion skills
	writing, speaking and listening, and the ability to comprehend and write	
	effective reports and design documentation, and to give and effectively	
	respond to clear instructions.	
6	An ability to work effectively as a member and leader in teams,	Individual
	preferably in a multi-disciplinary setting.	and
		teamwork
10	An ability to apply professional ethics, accountability, and equity.	Ethics and
		equity
12	An ability to identify and to address their own educational needs in a	Life-long
	changing world in ways sufficient to maintain their competence and to	learning
	allow them to contribute to the advancement of knowledge	

PROGE	RAM EDUCATIONAL OBJECTIVES (PEOs)
PFO1.	Enhance the entrepreneurial abilities, life skills and research initiates through
	experiential learning practices and building self confidence
PFO2.	Collaborate with industry and alumnae to explore the new avenues in respective
1 EO2.	domains and raise the employability ratio
PFO3.	Equip with soft skills and critical thinking to produce an erudite and trustworthy
1 EO3.	generation to fit into versatile situations
PFO4.	Adhere to the ethical and environmental sustainability to create morally upright and
1 EO4.	empowered citizens to face industry/ Institution
PFO5.	Up-skill / Re-skill their primary knowledge and potentials to compete in the
1 EO3.	dynamic global environment.
PFO6.	To build confidence to appear for Competitive / Civil Service examinations and to
1 EOU.	conquer commanding positions in organizational level.

PO NO	PROGRAMME OUTCOMES (POs)	
At the end	l of the programme, the students will be able to	
PO – 1	Demonstrate the knowledge and understanding of Science concepts and its relevant fields.	Disciplinary Knowledge
PO – 2	Identify, formulate, analyse complex problems and reach valid conclusions using the methodologies of Science.	Problem Solving
PO – 3	Employ critical and analytical thinking in understanding the concepts and apply them in various problems appearing in different branches of Science.	Analytical Reasoning & Critical Thinking
PO - 4	Communicate the known concepts effectively within the profession and with any forum	Communication Skills
PO - 5	Function successfully as a member/leader in any team and to apply ethics, accountability and equity in their life.	Team Work and Moral/Ethical Awareness
PO - 6	Use ICT tools in various learning situations, related information sources, suitable software to analyze data and furthermore participating in learning activities throughout life to meet the demands of work place through knowledge /up-skilling / re-skilling	Digital Literacy & Life-long Learning

PROG	RAM SPECIFIC OUTCOME (PSOs)					
PSO1:	Demonstrate the understanding of mathematical concepts in the field of Science a					
- 10 0	Technology.					
PSO2:	Express their mathematical knowledge with others effectively in both oral and					
	written form in an organized manner.					
PSO3:	Proficient in using digital learning platforms and update their knowledge, skills to					
	fulfill the requirements at the workplace in their life span.					
PSO4:	Employ critical and analytical thinking in understanding the concepts of					
	Mathematical Science and in appearing Competitive examinations SET/ NET/ TET.					
PSO5:	Choose appropriate mathematical and computational methods in order to solve					
	different types of problems and work efficiently as a team member / leader					
D 201	Work independently and do detailed study of various concepts of Science. Plan,					
PSO6 :	execute, report the results of an experiment/investigation with the highest standard					
	of ethics in research					

Bloom's Taxonomy



O Vanderbilt University Center for Teaching

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous), Pasumalai M.Sc., MATHEMATICS, Curriculum

Course	Title of the Course	Hours	Credits	Maximum Marks			
Code	The of the Course			Int	Ext	Total	
FIRST SEMESTER							
	Core Courses						
21PMTC11	Algebra	6	4	25	75	100	
21PMTC12	Analysis	6	4	25	75	100	
21PMTC13	Ordinary Differential Equations	6	4	25	75	100	
21PMTC14	Graph Theory and its Algorithms	6	4	25	75	100	
21PMTC15	Classical Mechanics	6	4	25	75	100	
	Total	30	20	125	375	500	
SECOND SE	MESTER				•		
21PMTC21	Advanced Algebra	6	4	25	75	100	
21PMTC22	Partial Differential Equations	6	4	25	75	100	
21PMTC23	Numerical Analysis	6	4	25	75	100	
21PMTC24	Fuzzy Algebra and its Applications	6	4	25	75	100	
21PMTN21	Mathematics for Competitive Examinations	6	6	25	75	100	
	Total	30	22	125	375	500	
THIRD SEM	IESTER			l			
21PMTC31	Field Theory and Lattices	6	4	25	75	100	
21PMTC32	Complex Analysis	6	4	25	75	100	
21PMTC33	Topology	6	4	25	75	100	
21PMTE31	Operations Research	6	6	25	75	100	
21PMTE32	Integral Equations	6	6	25	75	100	
	Total	30	24	125	375	500	
FOURTH SE	EMESTER						
21PMTC41	Measure Theory and Integration	6	4	25	75	100	
21PMTC42	Functional Analysis	6	4	25	75	100	
21PMTPR1	Project	6	4	40	60	100	
21PMTE41	Number Theory	6	6	25	75	100	
21PMTE42	Stochastic Process	6	6	25	75	100	
	Total	30	24	140	360	500	
	Grand Total	120	90	515	1485	2000	

(For the student admitted during the academic year 2021-2022 onwards)





MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	ALGEBRA						
Course Code	21PMTC11				L	Р	С
Category	Category Core				6	-	4
Nature of course	: EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPR	ENE	URSH	IP
Course Objectiv	res:						
• To introduce	the advanced ideas in Gr	oup tł	neory.				
• To familiariz	e Abelian groups and Rin	ng theo	ory.				
• To know abo	ut unique factorization de	omain					
• To equip the	students in fields and ide	als.					
• To know abo	ut Euclidean rings, Polyn	omial	rings.				
Unit: I						18	
Groups (Definition	ons only) - Subgroups -	A Co	ounting Principle - Norm	al subgroup	s and	Quoti	ent
groups - Permuta	tion groups.						
Unit: II .						18	
Another Countin	g Principle -Sylow's The	eorem	s - Direct Products – Fini	te Abelian (Group	s	
Unit: III						18	
Ideals and Quotie	ent Rings - More Ideals an	nd Qu	otient Rings, The Field of	of Quotients	of an	Integr	al
Domain							
Unit: IV						18	
Euclidean Rings	- A particular Euclidean	Rings	5.				
Unit: V						18	
Polynomial ring	s - Polynomials over the	e ratio	onal field - Polynomial	rings over	Comn	nutativ	ve
rings.							
			То	tal Lecture	Hou	s 90	
Books for Study: I. N. Herstein, Topics in Algebra, Second Edition, John Wiley and Sons,							
New Delhi, Repr	int 2010.						
	Unit I - Chapter 2: Sec	tions	2.1, 2.4, 2.5, 2.6, 2.10				
	Unit II - Chapter 2: Secti	$\cos 2$.11, 2.12, 2.13, 2.14				
	Unit III- Chapter 3: Secti	ions 3	.4, 3.5, 3.6,				
	Unit IV - Chapter 3: Sect	tions :	5.7, 5.8				
Dooleg for Dofor	Unit v - Chapter 5: Sec	ctions	5.9,5.10,5.11.				
DOOKS IOF REFERENCES:							
1. JOSEPH A Gaman, Contemporary Abstract Aigeora, 8 Edition, Cengage Learning India Private Limited New Delhi 2013							
2 Thomas W Hungerford Algebra Springer International Edition Newvork 2009							
3. Lang Serge Algebra . Addison – Welsey 2002							
Web Resources							
https://www.voutube.com/watch?v=PN-cro0J_v8&list=PLEAYkSg4uSO1Yhxu2U-							
BxtRjZElrfVVc	0						

https:/	/nptel.ac.in/courses/111/106/111106113/	
http://	<u>/www.freebookcentre.net/maths-books-download/Notes-on-Abstract-Algebra</u>	<mark>a-by-John-</mark>
Perry.	<u>html</u>	
COUR	SE OUTCOMES	K Level
On th	e successful completion of the course , the students will be able to	
CO1.	Demonstrate the understanding of group, normal groups, quotient group and	W)
COI	permutation groups.	N 2
CO2:	Use Sylow's theorem in algebraic structures	K4
CO3:	Examine ideals, quotient rings and integral domain	K3
CO4:	Analyse Euclidean ring	K5
CO5:	Classify the irreducibility of polynomials, rings over field	K4

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	1	3	2
CO 2	3	2	1	-	2	2
CO 3	2	3	-	1	2	1
CO 4	2	3	1	1	3	2
CO 5	2	2	1	1	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level <u>LESSON PLAN</u>

UNIT	COURSE NAME	Hours	Pedagogy
Ι	Groups (Definitions only) – Subgroups - A Counting Principle -	18	Chalk & Talk
II	Another Counting Principle -Sylow's Theorems - Direct Products – Finite Abelian Groups	18	Chalk &
III	Ideals and Quotient Rings - More Ideals and Quotient Rings, The Field of Quotients of an Integral Domain.	18	Chalk & Talk
IV	Euclidean Rings - A particular Euclidean Rings.	18	Chalk & Talk
V	Polynomial rings - Polynomials over the rational field - Polynomial rings over Commutative rings.	18	Chalk & Talk

Course Designed by: Dr.A.Hamari Choudhi and Dr.V.Ramachandran

	Learning Outcome Based Education & Assessment (LOBE)										
	Formative Examination - Blue Print										
	Section A Section B Section										
Into		K Level	Section	$\frac{1}{2}$	Section Showt Am		Section	Section D			
rnal	Cos				Short Ans	swers	C Fither or	Open			
11141			NO. 01. Questions	K - Level	NO. 01. Questions	N - Level	Choice	Choice			
CI	CO1	Unto K2	2.	K1&K2	<u>Questions</u>	K1	2	1			
		Upto K3	2	K1&K2	2	K2	2	1			
	002		2		<u> </u>	N2	2	1			
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1			
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1			
		No. of	4								
		Questions to			3		4	2			
		be asked									
		No. of									
Que	stion	Questions to	4		3		2	1			
Pat	tern	be answered									
CIA	I & II	Marks for	1		2		5	10			
		each question	n Mapping – K L Section A MCQs No. of. Questions 2 K 2 K 2 K 2 K 4 4 1		2		3	10			
		Total Marks									
		for each	4		6		10	10			
		section									

	Distribution of Marks with K Level CIA I & CIA II											
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %				
	K1	2	2			4	8	20				
	K2	2	4			6	12	20				
СТА	K3			10	10	20	40	40				
	K4			10	10	20	40	40				
•	Marks	4	6	20	20	50	100	100				
	K1	2	2			4	8	30				
CIA II	K2	2	4			6	12	20				
	K3			10	10	20	40	40				
	K4			10	10	20	40	40				
	Marks	4	6	20	20	50	100	100				

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course									
Outcomes (COs)									
S.No		K	MOQs		Short An	swers	Section C	Section D	
	COs	K- Lovel	No. of	K –	No. of	K –	(Either /	(Open	
		Level	Questions	Level	Question	Level	or Choice)	Choice)	
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)	
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)	
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)	
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)	
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)	
No.	of Questi	ons to be	10		5		10	5	
	Aske	d	10		5		10	3	
No.	of Questi	ons to be	10		5		5	3	
	answer	red	10		3		5	5	
Marks for each question			1		2		5	10	
Total Marks for each			10		10		25	20	
	sectio	n	10		10		25	30	
	(Figures	in parenthe	esis denotes.	questions s	hould be as	ked with	the given K	level)	

	Distribution of Marks with K Level											
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %					
K1	5	4			9	7.5	17					
K2	5	6			11	9.17	17					
K3			25	20	45	37.5	37					
K4			25	30	55	45.83	46					
Marks	10	10	50	50	120	100	100					
NB: Hig	gher level of p	erformance o	of the students	s is to be asse	essed by a	attempting	higher level					

of K levels.

Section	Section A (Multiple Choice Questions)								
Answei	r All Q	uestions	(10x1=10 marks)						
Q.No	CO	K Level	Questions						
1	CO1	K1							
2	CO1	K2							
3	CO2	K1							
4	CO2	K2							
5	CO3	K1							
6	CO3	K2							
7	CO4	K1							
8	CO4	K2							
9	CO5	K1							
10	CO5	K2							
Section	B (She	ort Answer	rs)						
Answei	r All Q	uestions	(5x2=10 marks)						
Q.No	CO	K Level	Questions						
11	CO1	K1							
12	CO2	K1							
13	CO3	K2							
14	CO4	K2							
15	CO5	K2							
Section	C (Eit	her/Or Ty	pe)						
Answei	r All Q	uestions	(5 x 5 = 25 marks)						
Q.No	CO	K Level	Questions						
16) a	CO1	K2							
16) b	CO1	K2							
17) a	CO2	K4							
17) b	CO2	K4							
18) a	CO3	K3							
18) b	CO3	K3							
19) a	CO4	K5							
19) b	CO4	K5							
20) a	CO5	K4							
20) b	CO5	K4							
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher						
level of	'K leve	ls							
Section	Section D (Open Choice)								
Answei	r Any 'l	Three ques	tions (3x10=30 marks)						
Q.No	CO	K Level	Questions						
21	COI	K2							
22	CO2	K4							
23	CO3	K3							
24	CO4	K5							
25	CO5	K4							

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	ANALYSIS								
Course Code	21PMTC12				L	Р	С		
Category	Core				6	-	4		
Nature of course	: EMPLOYABILITY	✓ SKILL	ORIENTED	✓ENTREPREM	NEUF	RSHI	P 🗸		
Course objectiv	es:	·		·			•		
 To acquire knowledge about continuous functions and its properties. 									
• To relate the derivative of real valued functions with continuous functions.									
• To impart the	fundamental theorem of	of Calculus.							
• To introduce	the concept of Riemann	integral.							
• To get an ide	a about the Sequences a	nd Series of	functions.						
Unit: I						1	8		
Limits of Func	tions - Continuous Fu	nctions - (Continuity and	Compactness -	Cont	tinuit	y and		
Connectedness -	Discontinuities - Mono	tonic Funct	ions - Infinite L	imits and Limits	at Inf	inity.			
Unit: II						1	8		
The Derivative	of a Real Function - 1	Mean Value	e Theorems –	The Continuity of	of De	rivati	ives –		
L'Hospital's Ru	le – Derivatives of Hig	gher Order	- Taylor's The	orem - Different	iation	of V	/ector		
valued Functions	,								
Unit: III						1	8		
The Riemann-St	ieltjes Integral- Definiti	on and Exis	tence of the Int	egral - Properties	of th	e Inte	egral -		
Integration and I	Differentiation - Integrat	ion of Vecto	or valued functi	ons -Rectifiable	Curve	s.	_		
Unit: IV 18									
Sequence and Se	ries of functions – Uni	form conve	rgence - Unifo	rm convergence	and C	Contin	nuity -		
Uniform converg	ence and Integration								
Unit: V						1	8		
Uniform Conver	gence and Differentiati	on – Equi-o	continuous Fan	nilies of Function	ns - 'I	he S	tone -		
Weierstrass Theo	orem						0		
				Total Lecture	Hou	s 9	0		
Books for Study				TT'11 T /		1	. , .		
Walter Rudin,	Principles of Mathem	natical An	alysis - McG	raw Hill Interna	itiona		itions,		
Unit L Chanton	es, Inira Edition (1976 A Section 4.1 4.24).							
Unit I: Chapter	4 Section $4.1 - 4.34$ 5 Section 5.1 5.10								
Unit III: Chapter	5 Section 5.1 $-$ 5.19								
Unit IV ·C	Section $0.1 = 0.27$ Section 7	-715							
$\begin{array}{ccc} \text{Unit } V & \mathcal{O} \\ \text{Unit } V & \mathcal{O} \end{array}$	hapter 7 Section 7	1 - 7.13							
Books for Refer	ences.	10 7.20							
1. Patrick M. F	Fitzpatrick. Advanced	Calculus.	AMS. Pine and	d Applied Under	rgradı	iate '	Texts.		
Indian Editio	n. 2006.		, i no un		0.000		,		
2. Apostol. Mat	thematical Analysis. N	arosa Publis	hing House. In	dian edition. 1974	1.				
3. H.L. Royden	, Real Analysis, Third	Edition, C	HI Learning F	vt Ltd., 3 rd Edit	ion, N	New	Delhi,		
2009.	•		U				-		
Web Resources									

https://nptel.ac.in/courses/111/106/111106053/ https://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2012/ https://cosmolearning.org/courses/real-analysis-with-prof-sh-kulkarni/						
COURSE OUTCOMES K Leve						
On th	On the successful completion of the course , the students will be able to					
CO1:	Knowledge about limit, continuity, connectedness and its properties.	K2				
CO2:	Identify the derivative of real valued functions with continuous concept and consequences	К3				
CO3:	Illustrate the derivatives of higher order, differentiation and integration	K3				
CO4:	Apply the fundamental theorem of sequence and series	K4				
CO5:	Importance of uniform convergence and Stone – Weierstrass theorem	K5				

CO & PO Mappings:

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	Limits of Functions - Continuous Functions - Continuity and Compactness - Continuity and Connectedness – Discontinuities - Monotonic Functions - Infinite Limits and Limits at Infinity.	18	Chalk & Talk
II	The Derivative of a Real Function - Mean Value Theorems – The Continuity of Derivatives – L'Hospital's Rule – Derivatives of Higher Order - Taylor's Theorem - Differentiation of Vector valued Functions	18	Chalk & Talk
III	The Riemann-Stieltjes Integral- Definition and Existence of the Integral - Properties of the Integral - Integration and Differentiation - Integration of Vector valued functions -Rectifiable Curves.	18	Chalk & Talk
IV	Sequence and Series of functions – Uniform convergence - Uniform convergence and Continuity - Uniform convergence and Integration	18	Chalk & Talk
V	Uniform Convergence and Differentiation - Equicontinuous Families of Functions - The Stone - Weierstrass Theorem	18	Chalk & Talk

Course Designed by: Mrs.S.Andal and Mrs. S.Ragavi

Learning Outcome Based Education & Assessment (LOBE)

	Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)									
Inte rnal	C			Section MC	on A Qs	Section B Short Answers		Section C	Section D	
	Cos		K Level	No. of. Questions	K - Level	No. of. Questions	K - Level	Choice	Choice	
CI	CO1		Upto K2	2	K1&K2	1	K1	2	1	
AI	CO	2	Upto K3	2	K1&K2	2	K2	2	1	
CI	CO	3	Upto K4	2	K1&K2	1	K2	2	1	
AII	CO	4	Upto K4	2	K1&K2	2	K2	2	1	
0.00	1		lo. of Questions to be asked	4		3		4	2	
Ques n Dotte	stio –	N t	lo. of Questions to be answered	4		3		2	1	
CIA I	I &	1	Marks for each question	1		2		5	10	
		Γ	Total Marks for each section	4		6		10	10	

	Distribution of Marks with K Level CIA I & CIA II											
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %				
	K1	2	2			4	8	20				
	K2	2	4			6	12	20				
СТА	K3			10	10	20	40	40				
	K4			10	10	20	40	40				
1	Marks	4	6	20	20	50	100	100				
	K1	2	2			4	8	20				
	K2	2	4			6	12	- 20				
CIA	K3			10	10	20	40	40				
II	K4			10	10	20	40	40				
	Marks	4	6	20	20	50	100	100				

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course										
				Dutcomes (CUS) Short An	CINO MG	Section C	Section D		
	~~		MO	<u>V</u> s	Short An	swers	Section	Section D		
S.No	COs	K - Level	No. of	K –	No. of	K –	(Either /	(Open		
			Questions	Level	Question	Level	or Choice)	Choice)		
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)		
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)		
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)		
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)		
No.	of Quest	ions to be	10		=		10	5		
	Aske	d	10		5		10	5		
No.	of Quest	ions to be	10		=		E	2		
	answe	red	10		5		5	5		
Marks for each question			1		2		5	10		
Total Marks for each			10		10		25	20		
section			10		10		25	30		
	(Figures	in parenthes	sis denotes, a	uestions sl	ould be ask	ked with	the given K l	evel)		

	Distribution of Marks with K Level									
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %			
K1	5	4			9	7.5	17			
K2	5	6			11	9.17	17			
K3			25	20	45	37.5	37			
K4			25	30	55	45.83	46			
Marks	10	10	50	50	120	100	100			
NB: Hig	gher level of p	erformance o	of the students	s is to be asse	essed by a	attempting	higher level			

of K levels.

Section	A (Mu	ıltiple Cho	ice Questions)
Answei	r All Q	uestions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Sho	ort Answer	rs)
Answei	r All Q	uestions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eit	her/Or Ty	pe)
Answei	r All Q	uestions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K2	
16) b	CO1	K2	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K3	
18) b	CO3	K3	
19) a	CO4	K4	
19) b	CO4	K4	
20) a	CO5	K5	
20) b	CO5	K5	
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher
level of	K leve	ls	
Section	D (Op	en Choice	
Answei	r Any T	Three ques	tions (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	<u>CO3</u>	K3	
24	CO4	K4	
25	CO5	K5	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	ORDINARY DIFFERE	INTI	AL EQUATIONS						
Course Code	21PMTC13				L	Р	С		
Category	Core				6	-	4		
Nature of cours	e: EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPREI	NEUF	RSHI	Р		
COURSE OBJ	ECTIVES:								
• To produce	knowledge on ODEs.								
• To familiarize with power series solution, special functions.									
• To learn about existence and uniqueness of solutions.									
• To solve hop	 To solve homogenous and non-homogenous equations 								
 To solve standard type of OD equations. 									
Unit: I						1	8		
Second order	homogeneous equation	Ini	tial Value Problem	Linear Dene	nden		nd		
Independence A	formula for Wronskian	Non-	-homogeneous equation	of order two	nuen	ce u	ina		
Independence, 7	r formula for wronskian,	11011	nomogeneous equation	of ofder two.		1	8		
	austion of order n Initia	$1 v_0$	luo probleme Appibile	tor mathad to	colu		.0		
homogeneous	yuation algebra of constant	ar va	afficient energiors	tor method to	50170		1-		
	quation, argeora or constan		emcient operators.			1	0		
	hlam fan tha hamaaanaan	~ ~ ~ ~	notion Colution of the L			L	.0 h.a		
Initial value pro	blem for the nomogeneou	s equ	lation, Solution of the F	lomogeneous	equat	ion, t	ne		
wronskian and	linear independence, Rec	lucti	on of the order of a no	mogeneous e	quatio	on, I	ne		
non-nomogeneo	us equation, Homogeneo	us e	quation with analytic c	oefficients, 1	ne Le	egenc	ire		
						1	0		
The Euler equat	ion Coord order correction		th Deculer Circular re	into on orrow	1		.0.		
The Euler equal	ion, Second order equalic	on w	the serveral asso	ints – an exam	npie,	Seco	na		
order equation	with Regular Singular p	onus bo D	a = the general case, F	a)	e proc	л, т	ne		
	s, The Dessel equation, T		esser equation (continue	u).		1	0		
Unit: V					•		.ð		
Equation with	ariable Separated, Exact	equ	ation, The method of S	Successive Ap	proxi	matic	ons,		
The Lipschitz C	ondition, Convergence of	the	Successive Approximat	tion, Non loca	l exis	tence	e of		
solution, Approx	kimation to and uniquenes	s of	solutions.				0		
	_		'	Fotal Lecture	Hou	rs 9	0		
Books for Stu	dy:								
E.A.Codd	ington, An Introduction	n to	Ordinary Differential	Equation , F	PHI L	earn	ing		
Privat	e Limited, New Delhi, 201	10.							
Unit I	- Chapter 2 : Section 1 to	6							
Unit I	I - Chapter 2 : Section	7 to	12						
Unit I	I - Chapter 3: Section 1 to	» 8							
Unit I	V - Chapter 4: Section 1	to 8							
Unit V	- Chapter 5: Section 1 t	to 8							
Books for Ref	erences:								
1. M.Rama Mo	ohan Rao, Ordinary Diffe	erent	ial Equations Theory a	and Application	ons,				

East West Press Publications, New Delhi, 1980.

- 2. Purna Chandra Biswal, **Ordinary Differential Equations**, PHI Learning Publications, New Delhi, 2012.
- 3. SG Deo, Ordinary Differential Equations, Tata Mc Graw Hill Publications, New Delhi, 2010.

Web Resources

https://nptel.ac.in/courses/111/107/111107111/

https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/video-lectures/ https://www.youtube.com/watch?v=CogfMjKUGc0

COUR	RSE OUTCOMES	K Level					
On the successful completion of the course , the students will be able to							
CO1:	Analyze the existence and uniqueness of solutions of ordinary differential						
	equations	N 4					
CO2:	Solve homogenous equation and non-homogenous equation with constant co-efficient	К3					
CO3.	Develop the concepts of ordinary differential equation for homogeneous and non-						
005.	homogenous equations.						
CO4:	Demonstrate the understanding of power series and special functions	K2					
CO5:	Compute the solution by iterative procedure for exact equation.	K 3					

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	-	3	1
CO 2	2	-	2	2	2	2
CO 3	2	2	2	-	3	1
CO 4	2	-	-	-	1	2
CO 5	3	-	2	1	2	2

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	Second order homogeneous equation, Initial Value Problem, Linear Dependence and Independence, A formula for Wronskian, Non- homogeneous equation of order two.	18	Chalk & Talk
II	Homogeneous equation of order n, Initial value problems, Annihilator method to solve non- homogeneous equation, algebra of constant coefficient operators.	18	Chalk & Talk
III	Initial value problem for the homogeneous equation, Solution of the Homogeneous equation, the Wronskian and linear independence, Reduction of the order of a homogeneous equation, The non-homogeneous equation, Homogeneous equation with analytic coefficients, The Legendre equation.	18	Chalk & Talk
IV	The Euler equation, Second order equation with Regular Singular points – an example, Second order equation with Regular Singular points – the general case, A convergence proof, The exceptional cases, The Bessel equation, The Bessel equation (continued).	18	Chalk & Talk
V	Equation with Variable Separated, Exact equation, The method of Successive Approximations, The Lipschitz Condition, Convergence of the Successive Approximation, Non local existence of solution, Approximation to and uniqueness of solutions.	18	Chalk & Talk

Course Designed by: Dr.M.Saravanan and Mrs. R.Sumathi

	Learning Outcome Based Education & Assessment (LOBE)									
	Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)									
Inte rnal	Con	V L and	Section A MCOs		Section B Short Answers		Section C	Section D		
	Cos	K Level	No. of. Questions	K - Level	No. of. Questions	K - Level	Choice	Open Choice		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1		
AI	CO2	2 Upto K3	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1		
		No. of Questions to be asked	4		3		4	2		
Question Pattern CIA I & II		No. of Questions to be answered	4		3		2	1		
		Marks for each question	1		2		5	10		
		Total Marks for each section	4		6		10	10		

	Distribution of Marks with K Level CIA I & CIA II									
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
СТА	K3			10	10	20	40	40		
	K4			10	10	20	40	40		
1	Marks	4	6	20	20	50	100	100		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
II	K4			10	10	20	40	40		
	Marks	4	6	20	20	50	100	100		

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes										
	(COs)									
			MO	Qs	Short An	swers	Section C	Section D		
S.No	COs	K - Level	No. of	К –	No. of	K –	(Either / or	(Open		
			Questions	Level	Question	Level	Choice)	Choice)		
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)		
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)		
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4& K4)	1(K3)		
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)		
No.	of Quest	ions to be	10		5		10	5		
	Aske	d	10		5		10			
No.	of Quest	ions to be	10		5		5	3		
	answe	red	10		5		5	5		
Marl	ks for eac	h question	1		2		5	10		
Tot	tal Marks	for each	10		10		25	30		
	sectio	on	10		10		23	50		
	(Figures	s in parenthe	sis denotes, o	uestions s	hould be as	ked with	the given K l	evel)		

	Distribution of Marks with K Level									
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %			
K1	5	4			9	7.5	17			
K2	5	6			11	9.17	17			
K3			25	20	45	37.5	37			
K4			25	30	55	45.83	46			
Marks	10	10	50	50	120	100	100			
NB: Hig	gher level of p	erformance o	of the students	s is to be asse	essed by a	ttempting	higher level			

of K levels.

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	СО	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	СО	K Level	Questions
16) a	CO1	K4	
16) b	CO1	K4	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K3	
18) b	CO3	K3	
19) a	CO4	K2	
19) b	CO4	K2	
20) a	CO5	K3	
20) b	CO5	K3	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questio	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K4	
22	CO2	K3	
23	CO3	K3	
24	CO4	K2	
25	CO5	K3	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	GRAPH THEORY AN	D II	TS ALGORITHMS							
Course Code	21PMTC14				L	Р	С			
Category	Core				6	-	4			
Nature of courses	: EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPRE	NEUF	RSHI	Р			
Course objective	es:									
• To understand	d the fundamental concep	ots in	n graph theory.							
• To apply grap	• To apply graph theory in different fields									
• To improve the different types of proof writing skills.										
• To learn to m	 To learn to model problems using graphs 									
 To solve the problems algorithmically. 										
Unit: I		-				1	8			
The Incidence and	d Adjacency Matrices. Si	uh g	raphs. Vertex degrees. F	Paths and Conr	ectio	n. Cv	cles.			
Sperner's lemma.	Trees. Cut edges and Bo	onds	. Cut vertices			, 0)	•••••			
Unit: II	, 11000, 0 <i>u</i> 0 0 6 00 unit 2 0		,			1	8			
Euler tours. Han	niltonian cycles. The tr	avel	ling salesman problem	Matchings.	Matcl	nings	and			
Coverings in Bin	artite graphs	u v e i	ing substitut problem	, 11400111155,			una			
Unit: III	and Brophis					1	8			
Edge Chromatic	Number, Vizing's Theore	em. (Chromatic number. Broo	ok's theorem.		-	0			
Unit: IV		, , , ,				1	8			
Plane and Planar	graphs, Dual Graphs, E	uler'	s formula Bridges Kur	atowski's The	orem	Dire	ected			
Graphs. Directed	Paths. Directed Cycles. I	Flow	s. Cuts. The Max-Flow	Min –Cut theo	orem.	, 21,	a			
Unit: V						1	8			
Algorithms : cor	nnectedness and compor	nents	s – spanning tree – cu	t vertices and	sepa	rabil	ity –			
directed circuits -	- shortest path algorithm	– pla	anarity testing – isomor	ohism	1		2			
	¥		r	Fotal Lecture	Hour	s 9	0			
Books for Study	:					•				
1. J.A.Bondy and	U.S.R.Murty, Graph The	eory	with Applications. Nor	th Holland						
Publications, Nev	v york, 1976.	•								
Unit I - C	hapter 1 : Section 1.3 to 1	1.7 a	ind 1.9							
C	hapter 2: Section 2.1 to 2	2.3								
Unit II – (Chapter 4: Section 4.1, 4.	2 an	d 4.4							
(Chapter 5: Section 5.1 to	5.2								
Unit III -	Chapter 6 : Section 6.1,	6.2								
	Chapter 8 : Section 8.1,	8.2								
Unit IV -	Chapter 9 : Section 9.1 t	o 9.:	5							
	Chapter 10 : Section 10.	1 to	10.3							
2. Narsingh Deo:	Graph Theory with Appl	licat	ions to Engineering and	Computer Scie	ence,					
Prentice Hall, 197	79.									
Unit V - C	Chapter 11 : Section 11.4	to 1	1.7							
Books for Refere	ences:									
1. John Clark	and Derek Allan H	Iolto	on, A first look a	t Graph T	heory	7, W	Vorld			
ScientificPub	lications, Singapore, 199	1.								

2. Ha	rary, Graph Theory, Narosa Publishing House, New Delhi, 1988.	
3. S.H	K.Yadav, Elements of Graph Theory, Ane Books Pvt. Ltd, New Delhi, 2010	
Web F	Resources	
https:	//nptel.ac.in/courses/111/106/111106102/	
https:/	//nptel.ac.in/courses/111/106/111106050/	
https:/	//www.math.kit.edu/iag6/lehre/graphtheo2015w/media/lecture_notes.pdf	
Course	e Outcomes	K Level
On th	e successful completion of the course , the students will be able to	
CO1:	Understand the definition of different types of graphs and Sperner's lemma.	K2
CO2:	Make use of graph theory concepts in travelling salesman problem, Matching and covering.	К3
CO3:	Categorize chromatic number, edge chromatic number with theorems.	K4
CO4:	Develop the different types of proof writing skills for planar graphs and directed graphs	K5
CO5:	Apply various types of algorithms in graph.	K3

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	-	-	2
CO 2	2	2	2	1	2	1
CO 3	2	1	1	1	2	-
CO 4	3	2	1	1	1	1
CO 5	3	2	3	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
	The Incidence and Adjacency Matrices, Sub graphs, Vertex degrees,		PPT, Chalk
Ι	Paths and Connection, Cycles, Sperner's lemma, Trees, Cut edges	18	&
	and Bonds, Cut vertices		Talk, quiz
п	Euler tours, Hamiltonian cycles, The travelling salesman problem,	18	Chalk &
11	Matchings, Matchings and Coverings in Bipartite graphs	10	Talk, PPT
тт	Edge Chromatic Number, Vizing's Theorem, Chromatic number,	18	Chalk &
111	Brook's theorem	10	Talk
	Plane and Planar graphs, Dual Graphs ,Euler's formula ,Bridges ,		Chalk &
IV	Kuratowski's Theorem, Directed Graphs, Directed Paths, Directed	18	Talk,
	Cycles, Flows, Cuts, The Max-Flow Min –Cut theorem.		Assignment
	Algorithms : connectedness and components – spanning tree – cut		Chally &
V	vertices and separability – directed circuits – shortest path algorithm	18	Cliaik & Talla DDT
	– planarity testing – isomorphism		Taik, PP1

Course Designed by: Dr.V.Ramachandran and Dr.A.Hamari Choudhi

	Learning Outcome Based Education & Assessment (LOBE)								
	Formative Examination - Blue Print								
		Articulation N	/Iapping – K	Levels with	n Course Ou	tcomes ((COs)		
			Sectio	on A	Section	n B	Section	Section	
Inte	Con	K L ovol	MC	Qs	Short Ans	swers	С	D	
rnal	COS	K Level	No. of.	K -	No. of.	К -	Either or	Open	
			Questions	Level	Questions	Level	Choice	Choice	
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1	
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1	
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1	
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1	
		No. of Questions	4		3		4	r	
		to be asked	4		3		4	4	
Ques	tion	No. of Questions	4		3	2	2	1	
Patt	ern	to be answered	4		5		4	I	
CIA I &		Marks for each	1		2		5	10	
Π		question	1		4		3	10	
		Total Marks for	1		6		10	10	
		each section			U		10	10	

	Distribution of Marks with K Level CIA I & CIA II									
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
СТА	K3			10	10	20	40	40		
	K4			10	10	20	40	40		
1	Marks	4	6	20	20	50	100	100		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
II	K4			10	10	20	40	40		
	Marks	4	6	20	20	50	100	100		

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)							
S.No	COs	K - Level	MO No. of Question	Qs K – Level	Short An No. of Question	swers K – Level	Section C (Either / or Choice)	Section D (Open Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Quest Aske	ions to be d	10		5		10	5
No.	of Quest answe	ions to be red	10		5		5	3
Marks for each question		1		2		5	10	
Total Marks for each section		10		10		25	30	
	(Figures	in parenthes	sis denotes,	questions s	hould be as	ked with	n the given K	level)

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	17		
K2	5	6			11	9.17	1/		
K3			25	20	45	37.5	37		
K4			25	30	55	45.83	46		
Marks	10	10	50	50	120	100	100		
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.								

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	СО	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	2)
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K2	
16) b	CO1	K2	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K4	
18) b	CO3	K4	
19) a	CO4	K4	
19) b	CO4	K4	
20) a	CO5	K3	
20) b	CO5	K3	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questio	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	COl	K2	
22	CO2	K3	
23	CO3	K4	
24	CO4	K5	
25	CO5	K3	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	CLASSICAL MECHA	CLASSICAL MECHANICS					
Course Code	21PMTC15				L	Р	С
Category	Core				6	-	4
Nature of course	e: EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPRE	ENEU	RSH	IIP
Course objectiv	ves:						
✤ To recall the	basic concepts of motion	n of a	particle.				
 To understand 	nd D' Alembert's Principl	e and	d Lagrangian's Formulat	ion.			
To derive th	e Lagrange's Equations fr	om I	Hamilton's Principle.				
✤ To apply the	he concept of the Equa	ation	s of Motion and the	Equivalent o	ne-dii	nens	ional
Problems.							
✤ To understar	nd the Kepler's law and Ir	ivers	e-Square Law of Force.				-
Unit: I		~				1	.8
Mechanics of a	Particle, Mechanics of a S	Syste	em of Particles, Constrain	ts.			
Unit: II						1	8
D'Alembert 's	principle and Lagrange's	equa	ations, Velocity – depen	dent potentia	ls ar	id i	the
dissipation fun	ction, Hamilton's princip	ple, S	Some techniques of the c	alculus of var	iation	s.	-
Unit: III						1	8
Derivation of L	agrange's equations from	Han	nilton's principle, Extens	ion of Hamilt	on's p	orinc	iple
to non-holonom	nic systems, Advantages	of	a variational principle	formulation,	Cons	erva	tion
theorems and Sy	mmetry properties.						-
Unit: IV	• • • •	1.1		1.0			8
Reduction to th	e equivalent one – body j	probl	lem. The equations of m	otion and firs	t integ	grals,	, The
equivalent one –	-dimensional problem and	Clas	ssification of orbits, The	virial theorem	1	1	0
	1 (1 (1 1))	1	· / 11 1	· · · 1 · C	1 1.	· 1	8
The Differentia	al equation for the orbit	and	integrable power – law	potentials, C		ions	ior
in time in the Ke	ertrand s theorem), The K		r problem : Inverse squa	re law of forc	e, m	e mo	uon
	pier problem, The Laplac	е – г	runge- Lenz vector.	atal Laatuma	Uom		0
Books for Stud	x7.0		1	otal Lecture	noui	5 9	0
H Goldstein C	y. Iassical Mechanics, Seco	nd F	dition Addison Wesley	Newvork 19	80		
Init I	- Chanter 1	Secti	ion 1.1 to 1.3	itewyork, i	00.		
Unit II	- Chapter 1 :	Secti	1415 & Chapter 2	Section 2.1	2.2		
Unit III -	Chapter 2 : Section	2.3 t	to 2.6		2.2		
Unit IV -	Chapter 3 : Section	3.1 t	to 3.4				
Unit V -	Chapter 3 : Section	3.5 t	to 3.9				
Books for Refe	rences:						
1. Madhumang	al, A Course on Classical	Mec	chanics, Narosa Publishir	ng Private Ltd	l, New	7	
2 B D Gupta	Satva Prakash Classical N	Mech	anics 6 th Edition Kedar	Nath Ram Ne	ath		
Publications	Mearut 1987-1988	vicen	unico, o Lunion, Keua				
3. R Donglas	Fregory Classical Mechan	nice (ambridge University Pr	288			
Weh Resources	5105017, Classical Moollal	,(
TTED RESources							

http:/	//staff.um.edu.mt/jmus1/diffeq1.pdf	
https:/	/ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-not	es/
http://i	math.huji.ac.il/~razk/Teaching/LectureNotes/LectureNotesMechanics.pdf	
COUR	SE OUTCOMES	K Level
On th	e successful completion of the course, the students will be able to	
CO1.	Demonstrate the understanding of the fundamental concepts in dynamics of	K)
COI	system of particle.	N 2
CO2:	Derive D'Alembert 's principle, Lagrange's equations and Hamilton's principle.	K4
CO3.	Represent the complicated mechanical systems using the Lagrangian and	K)
C03.	Hamiltonian principle.	N2
CO4:	Explain the concepts of one -dimensional problem and Classification of orbits.	K3
CO5.	Derive Bertrand's theorem, The Kepler problem, the Laplace – Runge- Lenz	V A
05:	vector.	N4

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	1	1	-
CO 2	3	3	3	1	2	2
CO 3	3	2	3	1	1	1
CO 4	3	2	2	1	2	1
CO 5	3	3	3	2	2	2

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	Mechanics of a Particle, Mechanics of a System of Particles, Constraints.	18	Chalk & Talk
II	D'Alembert 's principle and Lagrange's equations, Velocity – dependent potentials and the dissipation function, Hamilton's principle, Some techniques of the calculus of variations	18	Chalk & Talk
Ш	Derivation of Lagrange's equations from Hamilton's principle, Extension of Hamilton's principle to non-holonomic systems, Advantages of a variational principle formulation, Conservation theorems and Symmetry properties.	18	Chalk & Talk
IV	Reduction to the equivalent one – body problem. The equations of motion and first integrals, The equivalent one –dimensional problem and classification of orbits, The virial theorem	18	Chalk & Talk
V	The differential equation for the orbit and integrable power – law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem : Inverse square law of force, The motion in time in the Kepler problem, The Laplace – Runge- Lenz vector.	18	Chalk & Talk

Course Designed by: Dr.S.Andal and Dr.R.Bhavani

	Learning Outcome Based Education & Assessment (LOBE)								
	Formative Examination - Blue Print								
		Articulation	Mapping – l	K Levels wit	th Course O	itcomes	(COs)		
			Section A		Section B		Section	Section D	
Inte	Cos	K Lovol	MCQs		Short Answers		С	Onen	
rnal	COS	K Level	No. of.	V Lovel	No. of.	K -	Either or	Choice	
			Questions	K - Level	Questions	Level	Choice	Unoice	
CI	CO1	Upto K2	2	K1& K2	1	K1	2	1	
AI	CO2	Upto K3	2	K1& K2	2	K2	2	1	
CI	CO3	Upto K4	2	K1& K2	1	K2	2	1	
AII	CO4	Upto K4	2	K1& K2	2	K2	2	1	
Question Pattern CIA I & II		No. of Questions	4		3		4	2	
		to be asked	-		5		-		
		No. of Questions			3	3	2	1	
		to be answered	-		5		4	1	
		Marks for each			2		5	10	
		question	1		4		5	10	
		Total Marks for	1		6		10	10	
		each section	-		U		10	10	

	Distribution of Marks with K Level CIA I & CIA II								
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
СТА	K3			10	10	20	40	40	
I	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	
	K1	2	2			4	8	20	
CIA II	K2	2	4			6	12	20	
	K3			10	10	20	40	40	
	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course								
		Outcomes MOOr		(COS)		Section C	Section D	
C N	COs	K - Level			Short Al	Short Answers		Section D
S.No			No. of	K –	No. of	K –	(Either /	(Open
			Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No. of Questions to be			10		5		10	5
Asked				3		10	5	
No. of Questions to be			10		5		5	2
answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each			10		10		25	20
section			10		10		25	- 50
(Figures in parenthesis denotes, questions should be asked with the given K level)								

Distribution of Marks with K Level							
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	4			9	7.5	17
K2	5	6			11	9.17	17
K3			25	20	45	37.5	37
K4			25	30	55	45.83	46
Marks	10	10	50	50	120	100	100
ND. Higher level of nonfermance of the students is to be agagged by attempting higher level							

NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.

Section	Section A (Multiple Choice Questions)						
Answe	nswer All Questions (10x1=10 marks						
Q.No	CO	K Level	Questions				
1	CO1	K1					
2	CO1	K2					
3	CO2	K1					
4	CO2	K2					
5	CO3	K1					
6	CO3	K2					
7	CO4	K1					
8	CO4	K2					
9	CO5	K1					
10	CO5	K2					
Section	B (She	ort Answer	rs)				
Answe	r All Q	uestions	(5x2=10 marks)				
Q.No	CO	K Level	Questions				
11	CO1	K1					
12	CO2	K1					
13	CO3	K2					
14	CO4	K2					
15	CO5	K2					
Section	C (Eit	her/Or Ty	pe)				
Answe	r All Q	uestions	(5 x 5 = 25 marks)				
Q.No	CO	K Level	Questions				
16) a	CO1	K2					
16) b	CO1	K2					
17) a	CO2	K4					
17) b	CO2	K4					
18) a	CO3	K2					
18) b	CO3	K2					
19) a	CO4	K3					
19) b	CO4	K3					
20) a	CO5	K4					
20) b	CO5	K4					
NB: Higher level of performance of the students is to be assessed by attempting higher							
level of K levels							
Section D (Open Choice)							
Answei	r Any 'l	l'hree ques	tions (3x10=30 marks)				
Q.No	CO	K Level	Questions				
21	COI	K2					
22	CO2	K4					
23	CO3	K2					
24	CO4	K3					
25	CO5	K4					

Summative Examinations - Question Paper – Format




MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	ADVANCED ALGEBRA							
Course Code	21PMTC21			L	Р	С		
Category	Core					4		
Nature of cours	e: EMPLOYABILITY 🖌 SKILL ORIE	ENTED	ENTREPREM	NEUF	RSHI	Р		
Course objectiv	/es:							
• To familiari	ze various methods on solving algebraic equa	ations.						
• To introduce	e Schwarz's inequality.							
• To explain a	bout various transformations.							
• To study ab	out determinants.							
• To explain o	anonical and triangular forms.							
Unit: I					1	8		
Elementary Bas	ic Concepts - Dual Spaces - Inner Product S	paces.						
Unit: II					1	8		
The Algebra of	linear transformations, Characteristic roots				<u> </u>	-		
Unit: III					1	8		
Canonical form	s, Triangular form, Nilpotent transformations	8			1	0		
Unit: IV					1	8		
Trace and Trans	pose, Determinants.				1	0		
Hermitian Unit	ary and Normal transformations				1	0		
Tierinitian, Oni						0		
		, 	l'otal Lecture	Hou	rs 9	0		
I. N.Herstein, T 2010.	y. opics in Algebra, Second Edition, John Wile	ey and Sor	ns, New Delhi,	Repi	rint			
Unit I	- Chapter 4: Section 4.1, 4.3 ,4.4.							
Unit I	- Chapter 6: Section 6.1 and 6.2							
Unit I	I - Chapter 6: Sections 6.4 and 6.5							
Unit I	V - Chapter 6 : Section 6.8 and 6.9							
Unit V	- Chapter 6: Section 6.10							
 Books for Refe 1. Thomas W.J 2. M.L. Khann 3. Martin Isaa Delhi, 2009 Web Resources 	rences: Hungerford, Algebra, Spinger International E a, Linear Algebra, Jai PrakashNath Publicat cs ,Algebra, Library of Congress Catalogin	Edition, N tions, Mee g-in-Publ	ewyork, 2009. erut, 1984. ication Data, 1	Editio	on, N	ew		
https://nptel.ac https://www.yo wKsoopBN3	. <u>in/courses/111/106/111106131/</u> utube.com/watch?v=yKRbG9Y5pYY&list	=PLEAY	kSg4uSQ3Aa	NON5	oCb	<u>S6ec</u>		
https://www.yo	utube.com/watch?v=cDCFS68W7ZA							

Academic Council Meeting Held On 29.04.2021

Course	Course outcomes:				
On th	e successful completion of the course , the students will be able to				
CO1:	Explain the properties of Inner Product Spaces.	K2			
CO2:	Use linear transformation for characteristic roots and vectors	K3			
CO3:	Represent Canonical forms, Triangular form, Nilpotent transformations	K2			
CO4:	Determine the Trace and transpose, determinants	K3			
CO5:	Evaluate the normal transformation	K5			

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	2	1	1
CO 2	3	2	2	1	1	2
CO 3	3	2	1	2	1	1
CO 4	3	3	2	1	2	2
CO 5	3	2	2	1	1	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	Elementary Basic Concepts - Dual Spaces – Inner Product Spaces.	18	Chalk & Talk
II	The Algebra of linear transformations, Characteristic roots	18	Chalk & Talk
III	Trace and Transpose, Determinants.	18	Chalk & Talk
IV	Trace and Transpose, Determinants.	18	Chalk & Talk
V	Hermitian, Unitary and Normal transformations.	18	Chalk & Talk

Course Designed by: Dr.A.Hamari Choudhi and Dr.V.Ramachandran

	Learning Outcome Based Education & Assessment (LOBE)										
	Formative Examination - Blue Print										
			Articulation	Mapping –	K Levels w	vith Course C	Jutcome	s (COs)			
				Sectio	on A	Section	B	Section C	Section D		
Inte	Co	a di second	K I ovol	MC	Qs	Short Ans	swers	Section C	Open		
rnal		12	K Level	No. of.	K -	No. of.	К-	Choice	Choice		
				Questions	Level	Questions	Level	Choice	Choice		
CI	CC)1	Upto K2	2	K1&K2	1	K1	2	1		
AI	CC)2	Upto K3	2	K1&K2	2	K2	2	1		
CI	CC)3	Upto K4	2	K1& K2	1	K2	2	1		
AII	CC)4	Upto K4	2	K1&K2	2	K2	2	1		
		N	o. of Questions	4		3		4	2		
Ques	tio	N	of Questions								
n D ((t	be answered	4		3		2	1		
Pattern –		N	Iarks for each	1		2		5	10		
	T		question	L		4		5	10		
	<u>ж</u> п –		otal Marks for	4		6		10	10		
			each section	4		U		10	10		

	Distribution of Marks with K Level CIA I & CIA II										
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
СТА	K3			10	10	20	40	40			
	K4			10	10	20	40	40			
1	Marks	4	6	20	20	50	100	100			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
CIA	K3			10	10	20	40	40			
II	K4			10	10	20	40	40			
	Marks	4	6	20	20	50	100	100			

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course									
Outcomes (COs)										
	S.No COs	V	MC	Qs	Short An	swers	Section C	Section D		
S.No		K -	No. of	K –	No. of	K –	(Either /	(Open		
		Level	Questions	Level	Question	Level	or Choice)	Choice)		
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)		
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)		
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)		
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)		
No.	of Questi	ons to be	10		5		10	5		
	Aske	d	10		5		10	5		
No.	of Questi	ons to be	10		5		5	3		
	answer	ed	10		5		5	3		
Marks for each question			1		2		5	10		
Total Marks for each		10		10		25	20			
	sectio	n	10		10		25	30		
	(Figures	in parenthe	esis denotes,	questions s	hould be as	ked witl	n the given K	level)		

	Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %				
K1	5	4			9	7.5	17				
K2	5	6			11	9.17	1/				
K3			25	20	45	37.5	37				
K4			25	30	55	45.83	46				
Marks	10	10	50	50	120	100	100				
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels										

Section	A (Mu	iltiple Cho	ice Questions)
Answei	r All Q	uestions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Sho	ort Answer	rs)
Answei	r All Q	uestions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eit	her/Or Ty	pe)
Answei	r All Q	uestions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	COl	K2	
16) b	COI	K2	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K2	
18) b	CO3	K2	
19) a	CO4	K3 K2	
19) b	CO4	K3	
20) a	C05	K4	
20) b	0.05		
NB: Hi	gher le	vel of perio	ormance of the students is to be assessed by attempting higher
level of	N leve	15 or Chaine	
Answor	r Any T	Three ques) tions (3x10-30 morks)
		K L ovol	Ouestions
21	C01	K2	Questions
21	CO^{1}	K3	
22	CO_2	K2	
23	CO3	K3	
25	CO_{τ}	K5	
23	005	KJ	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	PARTIAL DIFFERENTIAL EQUATIONS			
Course Code	21 PMTC22	L	Р	С
Category	Core	6	-	4
Nature of cours	e: EMPLOYABILITY 🖌 SKILL ORIENTED 🛛 ENTREPREI	NEUF	SHI	P
Course objectiv	/es:			
• To study abo	out linear classifications of partial differential equations.			
• To solve dif	ferent types of PDEs using various methods.			
• To classify s	second order PDEs.			
• To derive or	e dimensional wave and heat conduction equations.			
• To solve Dir	richlet's and Neumann's Problem in various domain.			
Unit: I			1	8
P.D.E –Curves a	and Surfaces – Genesis of First Order P.D.E – Classification of Integ	rals -	Line	ear
Equation of the	first Order – Partial Differential Equation –Compatible Systems	– C	harpi	t's
Method – Jacobi	's Method.		•	
Unit: II			1	8
Integral Surface	es Through a Given Curve –Quasi-Linear Equation –Non- Linear Fi	irst O	rder	
P.D.E.				
Unit: III			1	8
Second Order P	.D.E.: Genesis of Second Order P.D.E - Classification of Second	Order	P.D	E -
One- Dimension	al Wave Equation – Vibration of an Infinite String –Vibration of a S	lemi -	- infi	nite
String – Vibratio	on of a String of Finite Length (Method of Separation of Variables).			
Unit: IV			1	8
Laplace's Equa	tion Boundary Value Problems- Maximum and Minimum Principle	- The	Cau	chy
Problem – The	Dirichlet Problem for the Upper Half Plane - The Neumann Pro-	oblem	for	the
Upper Half Plan	ne – The Dirichlet Interior Problem for a Circle – The Dirichlet Ext	erior	Prob	em
for a Circle – '	The Neumann Problem for Circle – The Dirichlet Problem for a	Rec	tangl	e —
Harnack's Theor	rem.		<u> </u>	
Unit: V			1	8
Green's function	on, Heat Conduction Problem – Heat Conduction –Infinite Roc		ase-	Heat
Conduction Fini	te Rod Case – Duhamel's Principle – Wave Equation –Heat Conduct	tion E	quat	on
	Total Lecture	Hou	·s 9	0
Books for Stud	y:			
T.Amarnath, A	n Elementary Course in Partial Differential Equation, Narosa Pul	blishi	ng	
Company, Chen	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11		
Unit I -	Chapter 1: Section 1.1 to 1.8 Unit II - Chapter 1: Section 1.9 to 1.	.11		
Unit III -	Chapter 2: Section 2.1 to 2.3 (2.3.1 to 2.3.3 and 2.3.5) Chapter 2: Section 2.4 $1 \neq 2.4 \neq 10$			
	- Chapter 2: Section 2.4.1 to 2.4.10 Chapter 2: Section 2.4 (2.4.11 to 2.4.12)			
Unit v	- Chapter 2 : Section 2.4 (2.4.11 to 2.4.13) Section 2.5 (2.5 land 2.5 2)			
	Section 2.5 (2.5.1 and 2.5.2) Section 2.6 (2.6.1 and 2.6.2)			
Rooks for Defe	SCOUDII 2.0 (2.0.1 dilu 2.0.2)			
1 ET Conson	Partial differential equations S. Chand and Company I to New	Delh	109	1
2 Jeffrey Raio	h Partial differential equations, S. Chanu and Company Liu., New	וווס ת 1	, 170	⊣.
2. Juney Kale	n, Flements of Partial Differential Fountions. Mc Grow Hill R	1. 00k (⁷ Omr	anv
Books for Refer 1. E.T. Copson 2. Jeffrey Raic 3. Ian Sneddor	rences: a, Partial differential equations, S. Chand and Company Ltd., New b, Partial differential equations, Springer Publisher, Newyork, 199 a, Elements of Partial Differential Equations, Mc Graw-Hill B	Delhi 1. ook (, 198 Comp	4. Dany,

Academic Council Meeting Held On 29.04.2021

Ne	w Delhi, 1985.	
Web R	lesources	
https:	//www.iist.ac.in/sites/default/files/people/IN08026/Canonical_form.pdf.	
https:/	/nptel.ac.in/courses/111/107/111107111/	
https:/	<u>/nptel.ac.in/courses/122/107/122107037/</u>	
COUR	SE OUTCOMES	K Level
On th	e successful completion of the course , the students will be able to	
CO1:	Solve the Linear first order partial differential equations using various methods.	K3
cor.	Analyze the Semi-linear, Quasi-linear & Non-linear first order partial	K A
CO2:	differential equations.	N 4
CO3:	Classify the second order partial differential equations	K4
CO4.	Apply the concepts of partial differential equations in solving boundary value	K2
CO4:	problems.	КJ
CO5.	Determine the solutions for homogeneous and non-homogeneous partial	V2
005:	differential equations.	КJ

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	1	3	1
CO 2	3	2	1	1	2	-
CO 3	3	2	1	-	2	1
CO 4	3	2	1	-	2	-
CO 5	3	2	1	1	2	-

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	P.D.E –Curves and Surfaces – Genesis of First Order P.D.E – Classification of Integrals – Linear Equation of the first Order – Partial Differential Equation –Compatible Systems – Charpit's Method – Jacobi's Method.	18	Chalk & Talk
II	Integral Surfaces Through a Given Curve –Quasi-Linear Equation –Non- Linear First Order P.D.E.	18	Chalk & Talk
III	Second Order P.D.E.: Genesis of Second Order P.D.E – Classification of Second Order P.D.E - One- Dimensional Wave Equation – Vibration of an Infinite String –Vibration of a Semi – infinite String – Vibration of a String of Finite Length (Method of Separation of Variables).	18	Chalk & Talk
IV	Laplace's Equation Boundary Value Problems- Maximum and Minimum Principle- The Cauchy Problem – The Dirichlet Problem for the Upper Half Plane – The Neumann Problem for the Upper Half Plane – The Dirichlet Interior Problem for a Circle – The Dirichlet Exterior Problem for a Circle – The Neumann Problem for Circle – The Dirichlet Problem for a Rectangle – Harnack's Theorem.	18	Chalk & Talk
v	Green's function, Heat Conduction Problem – Heat Conduction – Infinite Rod Case- Heat Conduction Finite Rod Case – Duhamel's Principle – Wave Equation –Heat Conduction Equation	18	Chalk & Talk

Course Designed by: Mrs.R.Sumathi and Dr.M.Saravanan

	Learning Outcome Based Education & Assessment (LOBE)									
	Formative Examination - Blue Print									
	Articulation Mapping – K Levels with Course Outcomes (COs)									
			Sectio	n A	Section	B	Section C	Section D		
Inte	Cos	K L ovol	MC	Qs	Short Ans	swers	Fither or	Open		
rnal	CUS	K Levei	No. of.	K -	No. of.	К-	Choice	Choice		
			Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1		
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1		
	N	o. of Questions	4		3		4	2		
Ques	ti	to be asked			5					
on	N	o. of Questions	4		3		2	1		
Patte	er to	be answered			5		<u> </u>	1		
n	N	Iarks for each	1		2		5	10		
CIA	IA I question		L				5	10		
& I]	[T	otal Marks for	1		6		10	20		
		each section			U		10	20		

	Distribution of Marks with K Level CIA I & CIA II									
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
СТА	K3			10	10	20	40	40		
	K4			10	10	20	40	40		
1	Marks	4	6	20	20	50	100	100		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
II	K4			10	10	20	40	40		
	Marks	4	6	20	20	50	100	100		

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course								
		K - Level	MC	Qs	Short Answers		Section C	Section D
S.No	COs		No. of	K –	No. of	K –	(Either /	(Open
			Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Questi	ons to be	10		5		10	5
	Aske	d	10		5		10	5
No.	of Questi	ons to be	10		5		5	3
	answer	red	10		5		5	5
Marks for each question		h question	1		2		5	10
Total Marks for each		10		10		25	30	
	section		10		10		20	50
	(Figures	in parenthe	esis denotes.	questions s	hould be as	ked witl	n the given K	level)

	Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %				
K1	5	4			9	7.5	17				
K2	5	6			11	9.17	17				
K3			25	20	45	37.5	37				
K4			25	30	55	45.83	46				
Marks	10	10	50	50	120	100	100				
NB: Hig	gher level of p	erformance o	of the students	s is to be asso	essed by a	attempting	higher level				

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	СО	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	СО	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	2)
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K3	
16) b	CO1	K3	
17) a	CO2	K4	
17) b	CO2	K4	
18) a	CO3	K4	
18) b	CO3	K4	
19) a	CO4	K3	
19) b	CO4	K3	
20) a	CO5	K3	
20) b	CO5	K3	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questio	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K3	
22	CO2	K4	
23	CO3	K4	
24	CO4	K3	
25	CO5	K3	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	NUMERICAL ANALYSIS							
Course Code	21 PMTC23	L	P	С				
Category	Core	6	-	4				
Nature of cours	e: EMPLOYABILITY 🖌 SKILL ORIENTED ENTREPRE	NEUF	SHI	P				
Course Objecti	ves:							
• To develop	To develop Numerical computational skills.							
• To practice	Numerical computational applications.							
To introduce	e difference equations and recurrence equations.							
• To demonstrate understanding and implementation of numerical solution of algorithms based								
for employa	for employability							
• To find the	errors in the approximation							
Unit: I			1	8				
Bisection metho	d - Iteration method (approximation method) based on first degree e	equation	on,					
second degree e	quation, General Iteration Methods .							
Unit: II			1	8				
Direct methods	: forward substitution method, back substitution method, Cram	er ru	le, C	auss				
elimination met	hod, Gauss Jordan method – triangulation method – LU decomposi	tion-	Chol	lesky				
method – Partiti	on method.							
Unit: III			1	8				
Iterative metho	ds - Jacobi iteration methods, Gauss-Seidel iteration metho	ods, S	Simil	arity				
transformation -	- Eigen values – Eigen vectors –Jacobi method for symmetric matric	es.	1	0				
Unit: IV			1	8				
Lagrange's and Newton Interpolation, Finite Difference Operators, Interpolating Polynomials								
using Finite Dif	ferences, Hermite Interpolation.	•						
Unit: V			1	8				
Numerical Diff	erentiation, Partial Differentiation, Numerical Integration, Meth	nods	based	l on				
Interpolation, C	omposite Integration methods.							
	Total Lecture	Hour	s 9	0				
Books for Stud	y:		_					
M.K.Jain, S.R.	K.Iyengar, R.K.Jain, Numerical Methods for scientific and	l Eng	ginee	ering				
computation –	4th edition, New age international Pvt limited, New Delhi, 2009.							
	Juit I - Chapter 2 : Section 2.1-2.4 and 2.6							
	Juit II - Chapter 3 : Section 3.1, 3.2							
	Juli III - Chapter 5: Section 5.4, 5.5 and 5.7							
	Juli IV - Chapter 4: Section 4.1 – 4.5 Juli V. Chapter 5: Section 5.1, 5.2, 5.5, 5.7, 5.0							
Doolta for Dofo	- Chapter 5 : Section 5.1, 5.2, 5.5 - 5.7, 5.9.							
1 G Shonkor I	rences: Dec. Numerical Analysis, New Age International publishers, New D	alhi 1	007					
1. U.Shalikal I 2 Rainar Kros	Auto, numerical Analysis, new Age international publishers, New L	2011, 1 2010	77 1.					
$\begin{array}{c} 2. \text{Kallel Kies} \\ 3 \text{SRK Ivend} \end{array}$	ar R K Iain Numerical Methods New age international Put limit	ed N	ew Γ	elhi				
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Web Resources	1							
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	'IN (' HILLO 20.04.2021		<u>, </u>	40				
Academic Co	uncil Meeting Held On 29.04.2021	ł	age (40				

http://	www.ece.mcmaster.ca/~xwu/part6.pdf					
http://	www.cis.upenn.edu/~cis515/cis515-12-sl2.pdf					
https://wiki.math.ntnu.no/_media/tma4215/2012h/note.pdf						
COURSE OUTCOMES K Level						
On th	e successful completion of the course , the students will be able to					
CO1.	Demonstrate the understanding of direct methods and iterative methods for					
COI.	equations	N 2				
CO2.	Apply proper methods for solving transcendental, algebraic and system of	K3				
CO2.	equations	K3				
CO3:	Evaluate interpolation and extrapolation using tabular values	K5				
CO4:	Associate tabular values with integration and differentiation	K2				
CO5:	Use iterative methods for PDE	K3				

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	3	2	3	2
CO 2	3	2	3	2	2	2
CO 3	2	2	2	2	3	2
CO 4	2	3	2	-	2	2
CO 5	2	2	-	-	2	-

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	Bisection method – Iteration method (approximation method) based on first degree equation, second degree equation, General Iteration Methods .	18	Chalk & Talk
Π	Direct methods: forward substitution method, back substitution method, Cramer rule, Gauss elimination method, Gauss Jordan method – triangulation method – LU decomposition– Cholesky method – Partition method.	18	Chalk & Talk
III	Iterative methods - Jacobi iteration methods, Gauss-Seidel iteration methods, Similarity transformation – Eigen values – Eigen vectors – Jacobi method for symmetric matrices.	18	Chalk & Talk
IV	Lagrange's and Newton Interpolation, Finite Difference Operators, Interpolating Polynomials using Finite Differences, Hermite Interpolation.	18	Chalk & Talk
V	Numerical Differentiation, Partial Differentiation, Numerical Integration, Methods based on Interpolation, Composite Integration methods.	18	Chalk & Talk

Course Designed by: Dr.M.Saravanan and Dr.A.Arivuchelvam

Learning Outcome Based Education & Assessment (LOBE)

Academic Council Meeting Held On 29.04.2021

	Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)									
Inte rnal	C	06		Section A MCQs		Section Short Ans	B	Section C Either or Choice	Section D	
	CUS		K Level	No. of. Questions	K - Level	No. of. Questions	K - Level		Choice	
CI	C	01	Upto K2	2	K1&K2	1	K1	2	1	
AI	CO)2	Upto K3	2	K1&K2	2	K2	2	1	
CI	I CO3		Upto K4	2	K1&K2	1	K2	2	1	
AII	CO)4	Upto K4	2	K1&K2	2	K2	2	1	
Ouor	tia	No. of Questions to be asked		4		3		4	2	
Quest n Patter CIA & II	110	No to	b. of Questions be answered	4		3		2	1	
	I	Marks for each question 1		1		2		5	10	
	1	Te	otal Marks for each section	4		6		10	10	

		D	istribution of	Marks wit	h K Level (CIAI&(CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA II	K3			10	10	20	40	40
	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
	Outcomes (COs)							
		K-	MC	Qs	Short An	swers	Section C	Section D
S.No	COs		No. of	K –	No. of	K –	(Either / or	(Open
		Level	Questions	Level	Question	Level	Choice)	Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No. o	of Quest	ions to be	10		5		10	5
	Aske	d	10		5		10	5
No. o	of Quest	ions to be	10		5		5	3
	answe	red	10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each		10		10		25	20	
section		10		10		25		
	(Figures	s in parenth	esis denotes,	questions	should be a	sked wit	h the given K	level)

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	17		
K2	5	6			11	9.17	17		
K3			25	20	45	37.5	37		
K4			25	30	55	45.83	46		
Marks	10	10	50	50	120	100	100		
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.								

Section	Section A (Multiple Choice Questions)						
Answei	r All Q	uestions	(10x1=10 marks)				
Q.No	CO	K Level	Questions				
1	CO1	K1					
2	CO1	K2					
3	CO2	K1					
4	CO2	K2					
5	CO3	K1					
6	CO3	K2					
7	CO4	K1					
8	CO4	K2					
9	CO5	K1					
10	CO5	K2					
Section	B (Sho	ort Answei	rs)				
Answei	r All Q	uestions	(5x2=10 marks)				
Q.No	CO	K Level	Questions				
11	COI	K1					
12	CO2	K1					
13	CO3	K2					
14	CO4	K2					
15	CO5	K2					
Section	C (Eit	her/Or Ty	pe)				
Answei	wer All Questions		$(5 \times 5 = 25 \text{ marks})$				
Q.No	CO	K Level	Questions				
16) a	C01	K2 K2					
10) 0	C01	N2					
$\frac{17}{a}$	$\frac{CO2}{CO2}$	K3 V2					
17)0 18)0	CO_2						
10)a 18)b	CO_3	<u></u> Κ4 Κ1					
10 0	CO_{4}	K4 K2					
19)a 10)b	C04	K2					
$\frac{19}{0}$	C04	K2 K3					
20) a	CO_{5}	K3					
20)0 NB• Hi	oher le	vel of nerf	ormance of the students is to be assessed by attempting higher				
level of	'K leve	le	ormance of the students is to be assessed by attempting ingher				
Section	\mathbf{D} (On	en Choice)				
Answer Any Three questions (3x10–30 mark							
O.No	CO	K Level	Ouestions				
21	C01	K2					
22	CO2	K3					
23	CO3	K5					
24	CO4	K2					
25	CO5	K3					
		1	l				

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name FUZZY ALGEBRA AND ITS APPLICATIONS	FUZZY ALGEBRA AND ITS APPLICATIONS							
Course Code 21PMTC24	L	Р	С					
Category Core	6	-	4					
Nature of course:EMPLOYABILITYImage: Mail ContentENTREPRIME	ENE	URSI	HIP					
Course Objectives:								
• To familiarize the concept of crisp set and its properties								
• To learn the basics of fuzzy sets and its operations								
• To differentiate crisp logic, multi-valued logic and fuzzy logic								
• To use inference theory in fuzzy logic								
• To learn the application in real life								
Unit: I		1	8					
Fuzzy sets: Basic types–Basic concepts – Additional properties of α – cuts – Represented to the set of the	senta	tion of	of					
fuzzy sets – Extension principle for fuzzy sets – Types of operations – Fuzzy comple	ment	s						
Unit: II		1	8					
Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Arithmetic	netic	oper	ation					
on fuzzy numbers		I						
Unit: III		1	8					
Fuzzy relation : Crisp versus Fuzzy relation – projection and cyclinderic extensions	s- Bir	arv f	fuzzv					
relation on a single set – fuzzy equivalence relations – Fuzzy compatibility relation	, 21	, and the second s	<i>w22</i> J					
Unit: IV		1	8					
Fuzzy logic: Classical logic – An over view – multi valued logic – Fuzzy propo	sitior	ns –F	uzzv					
quantifiers – Linguistic hedges – Inference from conditional fuzzy propositions –	Infere	ence	from					
conditional and quantified propositions – Inference from quantified propositions								
Unit: V		1	8					
Applications : Applications to Civil Engineering –Computer Engineering – Relia	bility	theo	orv –					
Robotics – Medicine – Economics.	5		5					
Total Lecture	Hou	s 9	0					
Books for Study:								
George J Klir and B.Yuan, Fuzzy sets and Fuzzy logic – Theory and application,	Secor	nd						
edition, Prentice Hall, New Delhi, 1995.								
Unit I - Chapter 1 : Sections 1.2 to 1.4								
Chapter 2 : Sections 2.1 to 2.3								
Chapter 3 : Sections 3.1,3.2								
Unit II - Chapter 4 : Section 4.1 to 4.4								
Unit III - Chapter 5 : Sections 5.1 to 5.6								
Unit IV - Chapter 8 : Sections 8.2 to 8.8								
Unit V - Chapter 16 : Sections 16.1, 16.2, 16.5 to 16.7,								
Chapter 17 : Sections 17.1 to 17.3.								
Books for References:		C						

1. H.J.Zimmermann, **Fuzzy Set Theory and its Applications**, Fourth Edition, Springer Publishers, New Delhi, 2006.

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- 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Willey, 2010.
- 3. Michal Baczynski and Balasubramaniam Jayaram, **Fuzzy Implications**, Springer Verlag, Heidelberg, 2008

Web Resources

https://www.thesisscientist.com/docs/Study%20Notes/66860129-5a91-459d-810f-

<u>54e0fc41175d</u> <u>https://ocw.mit.edu/courses/health-sciences-and-technology/hst-951j-medical-decision-</u> <u>support-spring-2003/lecture-notes/lecture4.pdf</u>

https://www.iitk.ac.in/eeold/archive/courses/2013/intel-info/d1pdf3.pdf https://nptel.ac.in/courses/106105173/2

mups.	//mptchac.m/courses/100105175/2					
https:/	https://www.cse.iitb.ac.in/~cs621-2011/lectures 2009/cs621-lect38-fuzzy-logic-2009-11-11.ppt					
COUR	COURSE OUTCOMES K Level					
On th	e successful completion of the course , the students will be able to					
CO1:	Interpret fuzzy set theory, representation, operation and extension principle	K2				
CO2:	Identify fuzzy numbers and its linguistic variables	K2				
CO3:	Validate fuzzy relation, projections and its equivalence.	K5				
CO4:	Analyse multi valued logic and fuzzy logic with inference theory	K3				
CO5:	Apply fuzziness in real valued problems	K3				

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	-	1	2	-
CO 2	2	2	-	-	2	-
CO 3	2	1	1	2	2	1
CO 4	2	1	1	2	2	1
CO 5	2	1	1	1	-	2

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	Fuzzy sets: Basic types– Basic concepts – Additional properties of α – cuts – Representation of fuzzy sets – Extension principle for fuzzy sets – Types of operations – Fuzzy complements	18	Chalk & Talk
II	Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Arithmetic operation on fuzzy numbers	18	Chalk & Talk
III	Fuzzy relation : Crisp versus Fuzzy relation – projection and cyclinderic extensions- Binary fuzzy relation on a single set – fuzzy equivalence relations – Fuzzy compatibility relation	18	Chalk & Talk
IV	Fuzzy logic: Classical logic – An over view – multi valued logic – Fuzzy propositions –Fuzzy quantifiers – Linguistic hedges – Inference from conditional fuzzy propositions – Inference from conditional and quantified propositions – Inference from quantified propositions	18	Chalk & Talk
V	Applications : Applications to Civil Engineering –Computer Engineering – Reliability theory – Robotics – Medicine – Economics.	18	Chalk & Talk

Course Designed by: Dr.M.Saravanan and Dr.P.Chitra Devi

	Learning Outcome Based Education & Assessment (LOBE)									
			Articulatio	l n N	Formative Apping –	Examinati K Levels w	on - Blue Pri vith Course C	nt Dutcome	s (COs)	
Inte rnal	Со	Cos K Level		Section AMCQsNo. of.K -		Section BShort AnswersNo. of.K -		Section C Either or Choice	Section D Open Choice	
CI	CO	1			uestions 2	Level	Questions	Level K1	2	1
AI	CO)1)2	Upto K3		$\frac{2}{2}$	K1&K2 K1&K2	2	KI K2	2	1
CI	CO	3	Upto K4		2	K1&K2	1	K2	2	1
AII	CO	94	Upto K4		2	K1&K2	2	K2	2	1
0	4.0	N	o. of Questions be asked	to	4		3		4	2
QuestioNo. ofnbe aPatternMarkCIA I &question		o. of Questions be answered	to	4		3		2	1	
			Marks for each question		1		2		5	10
11	II		Total Marks for each section	•	4		6		10	10

	Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Sumn	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes							
	(COs)							
			MCQs		Short Ar	swers	Section C	Section D
S.No	COs	K - Level	No. of Question s	K – Level	No. of Question	K – Level	(Either / or Choice)	(Open Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Quest Aske	ions to be d	10		5		10	5
No. of Questions to be answered		ions to be red	10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30
	(Figures	s in parenthe	sis denotes,	questions s	hould be as	ked with	the given K le	evel)

	Distribution of Marks with K Level							
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %	
K1	5	4			9	7.5	17	
K2	5	6			11	9.17	1/	
K3			25	20	45	37.5	37	
K4			25	30	55	45.83	46	
Marks	10	10	50	50	120	100	100	
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.							

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	СО	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K2	
16) b	CO1	K2	
17) a	CO2	K2	
17) b	CO2	K2	
18) a	CO3	K4	
18) b	CO3	K4	
19) a	CO4	K3	
19) b	CO4	K3	
20) a	CO5	K3	
20) b	CO5	K3	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questio	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K2	
23	CO3	K5	
24	CO4	K3	
25	CO5	K3	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name MATHEMATICS FOR COM	Course Name MATHEMATICS FOR COMPETITIVE EXAMINATIONS							
Course Code 21PMTN21			L	Р	С			
Category Non Major Elective Course			6	-	6			
Nature of course: EMPLOYABILITY SKI	LL ORIENTED	✓ ENTREPI	RENE	EURS	SHIP			
Course objectives:								
• To develop knowledge on numbers, data inter	pretation.							
• To familiarize the application through various	statistical methods.							
• To convert real data into a statistical data inter	pretation.							
• To use these concepts in competitive examination	tions.							
To develop the computational skills.								
Unit: I				1	8			
H.C.F. and L.C.M. of numbers – Simpli	fications.							
Unit: II				1	8			
Percentage – Profit and loss – Ratio and	l proportion.							
Unit: III	• •			1	8			
Time and work – Time and distance – P	roblems on Trains.							
Unite IV				1	0			
Unit: IV	Dommutation and Co	mhination			0			
The state st				1	0			
Unit: V	anha Dia sharta			1	0			
Data interpretation: Tabulation – Bar G	raphs – Pie charts.	T-4-114	TT		0			
Iotal Lecture Hours 90 Basks for Studes 90								
Aggarwal. R.S, Quantitative Aptitude , S.Char	d and Company Lt	d, 2009, New D	elhi.					
Unit I – Chapters 2 & 4 (Except exercises)								
Unit II – Chapters 10, 11 & 12 (Except exercise	s)							
Unit III – Chapters 15, 17 & 18 (Except exercise	es)							
Unit IV – Chapters 21, 22 & 30 (Except exercis	es)							
Unit V – Chapters 36, 37 & 38 (Except exercise	s)							
	5)							
Books for References:								
1. Abhigit Guha, Quantitative Aptitude , 4 th Ed	ition, Tata McGraw	Hill Publication	ons, 2	011,	New			
2 Mohan Dao II Quantitativa Antituda Saitaa	h Dublications Don	mint 2012 Char	noi					
2. Monali Rao. O, Quantilative Aptitude, Scied	n Publications, Rep	$\frac{1}{2000}$	lliai.					
J. Aggarwar, N.S., VCIDAL& IVOIL VCIDAL KCASO	ining, S.Chahu & C	10, 2009, INEW I						
https://theeompanyhov.com/ws.aggowyol.gwom	titativa antituda -	df frag down	and a					
https://www.topronkors.com/ovoms/guantitativ	<u>a antituda quastic</u>	ns_ndf/	Jau					
<u>nttps://www.toprankers.com/exams/quantitative-aptitude-questions-pdi/</u>								
<u>nups://www.sawaal.com/aputude-reasoning/quantitative-aptitude-aritnmetic-ability-</u> questions and answers html								
COURSE OUTCOMES				KI.	امرير			
On the successful completion of the course the	etudonta will ha	bla te		IN L.C				

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CO1:	Understand the concepts of Mathematics along with analytical ability	K2
CO2:	Develop the mathematical problem solving skill	K3
CO3:	Evaluate the problems on data interpretation	K5
CO4:	Identify the time related problems and solving	K4
CO5:	Illustrate appropriate methods for solving Permutation and Combination	K2

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	3	3	3	2
CO 2	3	2	3	3	3	3
CO 3	3	2	3	3	3	2
CO 4	3	3	2	3	3	2
CO 5	2	3	2	3	3	2

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
Ι	H.C.F. and L.C.M. of numbers – Simplifications.	18	Chalk & Talk
II	Percentage – Profit and loss – Ratio and proportion.	18	Chalk & Talk
III	Time and work – Time and distance – Problems on Trains.	18	Chalk & Talk
IV	Simple interest – Compound interest – Permutation and ombination.	18	Chalk & Talk
V	Data interpretation: Tabulation – Bar Graphs – Pie charts.	18	Chalk & Talk

Course Designed by: Mrs.S.Ragavi and Mrs.S.Andal

	Learning Outcome Based Education & Assessment (LOBE)								
	Formative Examination - Blue Print								
			Articulation	Mapping –	K Levels w	ith Course C	outcome	s (COs)	
				Section	on A	Sectior	n B	Section C	Section D
Inte	Co	G	K Lovel	MC	^C Qs	Short An	swers	Section C	Open
rnal Cos	8	K Level	No. of.	K Lovel	No. of.	К -	Choice	Choice	
				Questions	K - Level	Questions	Level	Choice	Choice
CI	CO	1	Upto K2	2	K1&K2	1	K1	2	1
AI	CO	2	Upto K3	2	K1&K2	2	K2	2	1
CI	CO	3	Upto K4	2	K1&K2	1	K2	2	1
AII	CO	4	Upto K4	2	K1&K2	2	K2	2	1
		Ν	o. of Questions	4		3		4	2
Oues	stio		to be asked						
n		N	o. of Questions	4		3		2	1
Patte	ern	t	o be answered						
CIA I &	I &	Marks for each		1		2		5	10
			question	-					* *
		Γ	Total Marks for	4		6		10	10
			each section	7		U		10	10

	Distribution of Marks with K Level CIA I & CIA II								
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
СТА	K3			10	10	20	40	40	
	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
CIA	K3			10	10	20	40	40	
II	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)							
S.No	COs	K - Level	MCQs No. of K – Questions Level		Short An No. of Questio n	nswers K – Level	Section C (Either / or Choice)	Section D (Open Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Questi Aske	ons to be d	10		5		10	5
No. of Questions to be answered		ons to be ed	10		5		5	3
Marks for each question		1		2		5	10	
Total Marks for each section		10		10		25	30	
	(Figures	in parenthe	esis denotes,	questions s	hould be a	sked witl	h the given K	level)

Distribution of Marks with K Level							
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	4			9	7.5	17
K2	5	6			11	9.17	17
K3			25	20	45	37.5	37
K4			25	30	55	45.83	46
Marks	10	10	50	50	120	100	100
NB: Hig	gher level of p	erformance o	of the students	s is to be asse	essed by a	ttempting	higher level

NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.

Section	A (Mu	Itiple Choi	ice Questions)
Answei	r All Qı	uestions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K 1	
10	CO5	K2	
Section	B (Sho	ort Answer	s)
Answei	r All Qı	uestions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eit	her/Or Tyj	pe)
Answei	r All Qu	iestions	$(5 \times 5 = 25 \text{ marks})$
Q.No	CO	K Level	Questions
16) a	COI	K2	
16) b	COI	K2 K2	
1/)a	CO2	K3	
1/) b	CO_2	K3	
18) a	CO3	K4	
18) b	CO3	K4	
19) a	C04	K4	
19) D 20) a	CO4	K4 1/2	
20) a	C05	K2 K2	
20) 0 ND, H:		N2	mean of the students is to be assessed by attempting higher level
ND: HI	gner le	ver or perio	ormance of the students is to be assessed by attempting higher level
Section	$\frac{veis}{D(\Omega n)}$	on Choice)	
Answei	r Anv T	Three quest	ions (3x10-30 marks)
	CO	K Level	Onestions
21	CO1	K2	Zucsuons
22	CO^2	K3	
23	CO3	K5	
24	CO4	K4	
25	CO5	K2	
25	005	114	

Summative Examinations - Question Paper – Format



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MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	FIELD THEORY AND L	.AT	FICES						
Course Code	21PMTC31				L	Р	С		
Category	Core				6	-	4		
Nature of cours	ENTREPREN	EUR	SHIP	>					
Course Objectives:									
• To make the students familiar with the concepts of Galois theory									
• To introduce application of Galois theory in solvability by radicals									
• To study about lattices and its special types									
• To make the students understand the aspects of field theory									
• To famil	iarize finite field theory		<u>,</u>						
Unit: I						18	3		
Fields, Extension	fields. Roots of polynomials								
Unit: II						18	3		
More about roots	, The elements of Galois theo	ory.							
Unit: III	,	2				18	3		
Solvability by Ra	adicals, Galois groups over the	e rat	ionals						
Unit: IV						18	;		
Finite fields, We	dderburn's Theorem on finite	divi	sion rings						
Unit: V						18	3		
Lattices: Lattices	and posets, lattices as posets	s. Su	b lattices; direct product	s, distributive lat	tices,	modu	lar		
and geometric lat	tices, Boolean lattices.								
			То	tal Lecture Ho	urs	<u>00 H</u>	[rs		
Books for Stud	y:								
1) Herstei	n.I.N, Topics in Algebra , S	Seco	ond Edition, John Wiley	y and Sons, 199	9, Ne	W			
Delhi.									
2) Garrotl	Birkoff and Thomas Bartee,	, Mo	odern Applied Algebra	a, CBC Publishe	ers an	d			
Distrib	utors, 1999, NewDelhi.								
Unit I- Text Bo	ok 1 : Chapter 5 : Sections	5.1,	5.3						
Unit II -Text B	ook 1 : Chapter 5 : Sections	5.5	,5.6						
Unit III - Text E	Book 1 : Chapter 5 : Section	is 5.'	7,5.8						
Unit IV - Text E	Book 1 : Chapter 7 : Section	ns 7.	1,7.2						
Unit V- Text Boo	k 2 : Chapter 9 : Sections 9.1	to 9	.7						
Books for Refe	rences:								
1. Vijay K.H	Khanna, "Lattices and Boo	olear	n Algebras", Second E	dition, Vikas Pı	ıblish	ing			
House Pv	t. Ltd,2008.								
2. John B.Fi	aleigh, "A First Course in	ı Ab	stract Algebra", Third	d Edition, Naros	sa				
Publisher	s, 2003, New Delhi.	T			100 -				
3. Patrick M	lorandi, "Field and Galois	The	eory", Springer Interna	tional Edition,	1996,				
New Delhi.									
Web Resources	<u>;</u>		10						
1. <u>https://jmilne</u>	.org/math/CourseNotes/F	<u>"T.p</u>	<u>df</u>				_		
2. <u>https://www.</u>	youtube.com/watch?v=Uk	<u>Y</u>	<u>JkonLBU&list=PL1i</u>	/Sp9JVsLltlFB	ytle:	Aq5	<u>uF</u>		

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1tV5 hB 3.https://www.youtube.com/watch?v=UjaD2eVYnQc&list=PL1iySp9JVsLltlFByt1e5Aq5uF1t V5 hB&index=2 **Course Outcomes** K Level On the successful completion of the course, the students will be able to Explain the notion of field theory. K4 **CO1: CO2:** Analyze the relationship between the ring, field and Galois theory. K4 **CO3:** Develop the proof of solvable group for radicals. **K3** Explain the finite division rings CO4: K4 **CO5:** Classify the different types of lattices K4

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	2	1	1	1
CO 2	3	2	3	1	1	1
CO 3	3	3	3	1	2	1
CO 4	3	3	3	2	2	1
CO 5	3	3	3	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Fields, Extension fields, Roots of polynomials	18	Chalk & Talk
II	More about roots, The elements of Galois theory.	18	Chalk & Talk, PPT
III	Solvability by Radicals, Galois groups over the rationals	18	Chalk & Talk
IV	Finite fields, Wedderburn's Theorem on finite division rings	18	Chalk & Talk, PPT
V	Lattices: Lattices and posets, lattices as posets. Sub lattices; direct products, distributive lattices, modular and geometric lattices, Boolean lattices.	18	Chalk & Talk, PPT

Course Designed by: Dr. A. Hamari Choudhi, Head & Associate Professor & Dr. V. Ramachandran, Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)											
Formative Examination - Blue Print												
	Articulation Mapping – K Levels with Course Outcomes (COs)											
			Sectio	n A	Section	B	Section C	Section D				
Inte	Cos	K L ovol	MC	Qs	Short Ans	swers	Fither or	Open				
rnal	CUS	K Level	No. of.	K -	No. of.	К-	Choice	Choice				
			Questions	Level	Questions	Level	Choice	Choice				
CI	CO 1	Upto K4	2	K1&K2	1	K1	2	1				
AI	CO2	2 Upto K4	2	K1&K2	2	K2	2	1				
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1				
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1				
	1	No. of Questions	1		3		1	2				
Ques	ti	to be asked			5			4				
on	1	No. of Questions	1		3		2	1				
Patte	Patter to be answered				5		4	1				
n		Marks for each	1		2		5	10				
CIA	CIA I question		I		4		3	10				
& I	[]	Total Marks for	1		6		10	10				
		each section	4		U		10	10				

	Distribution of Marks with K Level CIA I & CIA II										
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
СТА	K3			10	10	20	40	40			
	K4			10	10	20	40	40			
1	Marks	4	6	20	20	50	100	100			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
CIA	K3			10	10	20	40	40			
II	K4			10	10	20	40	40			
	Marks	4	6	20	20	50	100	100			

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course										
Outcomes (COs)										
		• 7	MCQs		Short Ar	nswers	Section C	Section D		
S.No	COs	K -	No. of	K –	No. of	K –	(Either /	(Open		
		Level	Questions	Level	Question	Level	or Choice)	Choice)		
1	CO1	Upto K4	2	K1&K2	1	K1	2(K2&K2)	1(K4)		
2	CO2	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)		
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)		
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)		
No.	of Questi	ons to be	10		5		10	5		
	Aske	d	10		5		10	5		
No.	of Questi	ons to be	10		5		5	2		
	answer	ed	10		3		5	3		
Marks for each question		1		2		5	10			
Total Marks for each section		10		10		25	30			
		10		10		25	30			
	(Figures	in parenthe	esis denotes,	questions s	hould be as	ked with	the given K l	evel)		

	Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %				
K1	5	4			9	7.5	24				
K2	5	6	20		31	25.9	34				
K3			30	10	40	33.3	33				
K4				40	40	33.3	33				
Marks	10	10	50	50	120	100	100				
NB: Hig of K lev	gher level of p els.	erformance o	of the students	s is to be asse	essed by a	attempting	higher level				

Section	Section A (Multiple Choice Questions)							
Answei	r All Q	uestions	(10x1=10 marks)					
Q.No	CO	K Level	Questions					
1	CO1	K1						
2	CO1	K2						
3	CO2	K1						
4	CO2	K2						
5	CO3	K1						
6	CO3	K2						
7	CO4	K1						
8	CO4	K2						
9	CO5	K1						
10	CO5	K2						
Section	B (Sho	ort Answer	rs)					
Answei	r All Q	uestions	(5x2=10 marks)					
Q.No	CO	K Level	Questions					
11	CO1	K1						
12	CO2	K1						
13	CO3	K2						
14	CO4	K2						
15	CO5	K2						
Section	C (Eit	her/Or Ty	pe)					
Answei	r All Q	uestions	(5 x 5 = 25 marks)					
Q.No	CO	K Level	Questions					
16) a	CO1	K2						
16) b	CO1	K2						
17) a	CO2	K3						
17) b	CO2	K3						
18) a	CO3	K3						
18) b	CO3	K3						
19) a	CO4	K3						
19) b	CO4	K3						
20) a	CO5	K2						
20) b	CO5	K2						
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher					
level of	K leve	ls						
Section	D (Op	en Choice						
Answei	r Any T	Three ques	tions (3x10=30 marks)					
Q.No	CO	K Level	Questions					
21	COl	K4						
22	CO2	K4						
23	<u>CO3</u>	K3						
24	<u>CO4</u>	K4						
25	CO5	K4						

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	COMPLEX ANALYSIS								
Course Code	21PMTC32			L	Р	С			
Category	Core			6	-	4			
Nature of cours	se: EMPLOYABILITY	SKILL ORIENTED	ENTREPF	RENU	RSH	IIP			
COURSE OBJ	COURSE OBJECTIVES:								
To under	rstand the concept of analyticity	, line integrals, residues.							
• To famil	• To familiarize Cauchy integral formula.								
To intro	duce Taylor and Laurent Series								
To intro	duce analytic function, complex	integration and Riemann	Zeta Functi	ion.					
To estim	nate integrals of special forms in	certain regions.							
Unit: I		0			1	8			
Introduction to t	the concept of Analytic Functio	n –Elementary theory of H	Power Series	S.					
Unit: II					1	8			
The Exponentia	1 and Trigonometric Function –	Conformality – Linear Ti	ransformatio	on					
Unit. III		200000000000000000000000000000000000000			1	8			
Fundamental Th	peorems – Cauchy's Integral Fo	rmula – Local properties (of Analytica	l Fun	ction	-			
Init. IV	leorenis Cadeny's integrario	Initia Local properties (51 7 marytica	.1 1 011		8			
The General for	m of Cauchy's Theorem – The	Calculus of Residues- Ha	rmonic Fund	ctions	 	-			
Unit: V 18						8			
Power Series Ex	Power Series Expansions – Partial Fractions and Factorization - Entire Functions – The					-			
Riemann Zeta F	Function.								
		Tot	tal Lecture	Hou	s 9	0			
Books for Stu	dv:								
Ahlfors, L.V., "C	Complex Analysis", Third Editic	on, McGraw Hill Internation	nal Company	y, 197	'9,				
New Delhi.	-		1						
Unit I : Chapter	2 : Section 1 and 2 (2.4 & 2.5)								
Unit II : Chapter	r 2 : Section 3								
Chapter 3 :	: Section 2 and 3 (3.1 to 3.3)								
Unit III: Chapte	r 4 : Section 1,2,3								
Unit IV: Chapte	er 4 : Section 4 (4.1 to 4.5), Sec	tion 5 & Section 6							
Unit V:Chapter	5: Section 1,2(2.1 & 2.2) and S	ection 3 & 4.							
Books for Ref	erences:	~	_						
1. Churchill, I	R.V, J.W. Brown and R.F. Verh	ey, Complex Variables a	and						
Applicatio	ons, McGraw – Hill Internation	al Company, 1974, NewD	elhı.	2006					
2. Conway, J.	B, Functions of one Complex	Variable, Narosa Publish	ing House,	2006,	Cher	inai.			
J. Karunakara	3. Karunakaran.V, Complex Analysis , Narosa Publishing House, 2005, Chennai.								
vved Kesource	ts	In a tag m df							
1. <u>nttps://v</u> 2. https://w	www.math.isu.edu/~neuDrand	<u>/notes.pai</u> 11061/1/							
$2. \frac{1100000000000000000000000000000000000$	ipici.ac.iii/cuuiscs/111/100/11 xww.youtube.com/watch?y_b	5VI nanu-as							
$\frac{1}{4} \frac{1}{1000} = \frac{1}{1$	www.youtube.com/watch?y=g	5 + Onapu-45 FilRKW89711&-lict-DI h	MV0gVi5r	15 ;	8vf \ /	WT			
	<u>m m mayoutube.com/ waten: v-g</u>		<u>111 1 05 1 101</u>			110			

Academic Council Meeting Held On 17.05.2022

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COURSE OUTCOMES							
On the	e successful completion of the course , the students will be able to						
CO1:	Explain the concept of complex function and power series	K4					
CO2:	Analyze the properties of Analytical Function	K4					
CO3:	Analyze the Cauchy's theorem for different closed curves	K4					
CO4:	Construct arguments effectively in proof of theorems in complex analysis	К3					
CO5:	Develop the series of complex function using Jensen's and Poisson formula	К3					

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	2	2	1
CO 2	3	3	3	2	1	1
CO 3	3	2	3	2	2	1
CO 4	3	2	2	2	1	1
CO 5	3	2	2	2	1	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
т	Introduction to the concept of Analytic Function – Residues –	18	Chalk &
1	Harmonic Elementary theory of Power Series.	10	Talk, PPT
п	The Exponential and Trigonometric Function – Conformality –	10	Chalk &
11	Linear Transformation	10	Talk, PPT
тт	Fundamental Theorems – Cauchy Integral Formula – Local	10	Chalk &
111	properties of Analytical Function.	10	Talk
137	The General form of Cauchy's Theorem – The Calculus of	10	Chalk &
1V	Functions.	10	Talk, PPT
N7	Power Series Expansions – Partial Fractions and Factorization	10	Chalk &
V	- Entire Functions – The Riemann Zeta Function.	10	Talk, PPT

Course Designed by:

Dr. R. Bhavani, Assistant Professor & Mrs. S. Ragavi, Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)									
Formative Examination - Blue Print										
	Articulation Mapping – K Levels with Course Outcomes (COs)									
		-	Sectio	on A	Sectior	n B	Section C	Section D		
Inte	Cos	K I ovol	MC	Qs	Short Answers		Section C	Open		
rnal	CUS	K LEVEI	No. of.	К-	No. of.	No. of. K -	Choico	Choico		
			Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K4	2	K1&K2	1	K1	2	1		
AI	CO2	Upto K4	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K3	2	K1&K2	2	K2	2	1		
		No. of			3		4	2		
		Questions to be	4							
		asked								
		No. of								
Que	estion	Questions to be	4		3		2	1		
Pat	tern	answered								
CIA I & II		Marks for each	1		2		5	10		
		question	1		2		2	10		
		Total Marks								
		for each	4		6		10	10		
		section								

	Distribution of Marks with K Level CIA I & CIA II										
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
СТА	K3			10	10	20	40	40			
	K4			10	10	20	40	40			
1	Marks	4	6	20	20	50	100	100			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
CIA	K3			10	10	20	40	40			
II	K4			10	10	20	40	40			
	Marks	4	6	20	20	50	100	100			

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.
S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
		TZ	MC	Outcomes Qs	(COs) Short An	swers	Section C	Section D
S.No	COs	K -	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K4	2	K1&K2	1	K1	2(K2&K2)	1(K4)
2	CO2	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Questi Aske	ons to be d	10		5		10	5
No. of Questions to be answered		10		5		5	3	
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30
	(Figures	in parenthe	sis denotes,	questions s	hould be as	ked witl	h the given K	level)

		Dis	stribution of	Marks with	n K Leve	l	
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	4			9	7.5	22
K2	5	6	20		31	25.8	55
K3			30	20	50	41.7	42
K4				30	30	25	25
Marks	10	10	50	50	120	100	100
NB: Hig of K lev	gher level of p els.	erformance o	of the students	s is to be asse	essed by a	ttempting	higher level

Section A (Multiple Choice Questions)						
Answer	All Qu	estions	(10x1=10 marks)			
Q.No	CO	K Level	Questions			
1	CO1	K1				
2	CO1	K2				
3	CO2	K1				
4	CO2	K2				
5	CO3	K1				
6	CO3	K2				
7	CO4	K1				
8	CO4	K2				
9	CO5	K1				
10	CO5	K2				
Section	B (Sho	rt Answers)				
Answer	All Qu	estions	(5x2=10 marks)			
Q.No	CO	K Level	Questions			
11	CO1	K1				
12	CO2	K1				
13	CO3	K2				
14	CO4	K2				
15	CO5	K2				
Section	C (Eith	er/Or Type	:)			
Answer	All Qu	estions	(5 x 5 = 25 marks)			
Q.No	CO	K Level	Questions			
16) a	CO1	K2				
16) b	CO1	K2				
17) a	CO2	K3				
17) b	CO2	K3				
18) a	CO3	K3				
18) b	CO3	K3				
19) a	CO4	K3				
19) b	CO4	K3				
20) a	CO5	K2				
20) b	CO5	K2				
NB: Hi	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K			
levels						
Section	D (Ope	n Choice)				
Answer	Any T	hree questio	ons (3x10=30 marks)			
Q.No	CO	K Level	Questions			
21	COI	K4				
22	CO2	K4				
23	<u>CO3</u>	K4				
24	CO4	K3				
25	005	K3				

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	TOPOLOGY						
Course Code	21PMTC33			L	Р	С	
Category	Core			6	-	4	
Nature of cours	e: EMPLOYABILITY	SKILL ORIENTED	ENTREPH	RENU	RSH	IIP	
COURSE OBJ	ECTIVES:						
• To fan	niliarize the basic concepts of Top	ology.					
• To lea	rn the various aspects of Topologi	cal spaces.					
 To stu 	dy the properties of topological sp	baces					
• To em	ich knowledge in metric topology	, connected, compact a	nd normal s	paces	•		
• To une	lerstand the concept of axioms.	, , , , , ,		1			
Unit: I	1				1	8	
Topological Spa	ces – Basis for a Topology - The	Order Topology – The	Product To	polog	v on		
XxY - The Subs	pace Topology – Closed sets and	limit points – Contir	nuous functi	ions –	The		
Product Topolog	v.	iiiii pointe contra	100000 101100				
Unit: II					1	8	
The Metric Top	plogy – Connected Spaces – Conn	ected Subspaces of the	Real Line				
Unit: III					1	8	
Compact Spaces	– Compact Subspaces of the real	line – Limit Point Con	npactness –	Loca	I		
Compactness.			T				
Unit: IV					1	8	
Countability Ax	oms - The Separation Axioms – N	Normal Spaces.					
Unit: V					1	8	
The Urysohn Le	mma – The Urysohnmetrization T	Theorem – Tietze Exten	sion Theore	m			
		Tot	al Lecture	Нош	·s 9	0	
Books for Stu	lv.	100	<u>ui Dectui e</u>	nou		-	
James R Mukres	" Topology " (Second Edition) Pre	ntice –Hall of India Priv	vate Ltd Ian	uarv			
1987. New Delhi			uto Eta, sun	uui y			
Unit I- Chapte	r 2 : Sections 12 to 19						
Unit II - Chapte	2 : Sections 20 and 21&						
Chapter	3: Sections23 and 24						
Unit III - Chapte	r 3 : Sections 26 to 29						
Unit IV - Chapt	er 4 : Sections 30 to 32						
Unit V - Chapt	er 4 : Sections 33 to35						
Books for Ref	erences:						
1. Gupta. K.P, T	pology, First Edition, Pragati Prak	ashan Educational, 1974	,Meerut-25	0001			
2. James Dugundji, Topology , Universal book stall, Reprint 1990, New Delhi							
3. Chandrasekhar	3. Chandrasekhara Rao, " Topology ", Narosa Publishing House, 2009, NewDelhi.						
Web Resource	S						
1. <u>http://w</u>	ww.uio.no/studier/emner/matna	t/math/MAT4500/h13	/topology.p	<u>df</u>			
2. <u>http://n</u>	tel.ac.in/courses/111106054/Top	oology%20complete%	20course.p	odf			

3.	http://home.iitk.ac.in/~chavan/topology_mth304.pdf					
4.	https://www.youtube.com/watch?v=XHKcrs8YaSo&list=PLbMVogVj5nJRR7zYZifY					
	opb52zjoScx1d					
COUF	COURSE OUTCOMES K Level					
On the	On the successful completion of the course , the students will be able to					
CO1:	Compare basis and sub basis in topological spaces	K4				
CO2:	Apply metric space in a topological space	K3				
CO3:	Analyze metrization and compactness of spaces	K4				
CO4 :	Explain the countability axioms and separation axioms and separability	K4				
CO5 :	Develop the logical arguments related to continuous functions on topological spaces.	K3				

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	2	1	2	1
CO 2	3	2	3	2	1	1
CO 3	3	2	2	1	1	1
CO 4	3	2	2	1	1	1
CO 5	3	2	2	1	1	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Topological Spaces – Basis for a Topology - The Order Topology – The Product Topology on XxY – The Subspace Topology – Closed sets and limit points – Continuous functions – The Product Topology.	18	Chalk & Talk, PPT
II	The Metric Topology – Connected Spaces – Connected Subspaces of the Real Line.	18	Chalk & Talk, PPT
III	Compact Spaces – Compact Subspaces of the real line – Limit Point Compactness – Local Compactness.	18	Chalk & Talk, PPT
IV	Countability Axioms - The Separation Axioms - Normal Spaces.	18	Chalk & Talk, PPT
V	The Urysohn Lemma – The Urysohn Metrization Theorem – Tietze Extension Theorem	18	Chalk & Talk, PPT

Course Designed by:

Dr. A. Arivu Chelvam, Assistant Professor & Dr. P. Chitra Devi, Assistant Professor

Learning Outcome Based Education & Assessment (LOBE)

	Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)								
Inte rnal	Со	os K Level		Section A MCQs No. of K -		Short Answers		Section C Either or	Section D Open
				Questions	Level	Questions	Level	Choice	Choice
CI	CO)1	Upto K4	2	K1&K2	1	K1	2	1
AI	CO	2	Upto K3	2	K1&K2	2	K2	2	1
CI	I CO3		Upto K4	2	K1&K2	1	K2	2	1
AII	CO	4	Upto K4	2	K1&K2	2	K2	2	1
0.00		N	lo. of Questions to be asked	4		3		4	2
Ques n Patte CIA		N t	lo. of Questions to be answered	4		3		2	1
	I &	ľ	Marks for each question	1		2		5	10
		Γ	Total Marks for each section	4		6		10	10

		Dist	tribution of 1	Marks wit	h K Level	CIA I &	CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
L	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
	Outcomes (COs)							
		V	MC	Qs	Short An	swers	Section C	Section D
S.No	COs	K -	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K4	2	K1&K2	1	K1	2(K2&K2)	1(K4)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Questi	ons to be	10		5		10	5
	Aske	d	10		5			
No.	of Questi	ons to be	10		5		5	3
	answer	ed	10		3		5	3
Marks for each question			1		2		5	10
Total Marks for each			10		10		25	20
section			10		10		25	30
	(Figures	in parenthe	sis denotes,	questions s	hould be as	ked with	n the given K	level)

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	42		
K2	5	6	30		41	34.2	42		
K3			20	20	40	33.3	33		
K4				30	30	25	25		
Marks	10	10	50	50	120	100	100		
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels								

Section	Section A (Multiple Choice Questions)						
Answer	All Qu	estions	(10x1=10 marks)				
Q.No	CO	K Level	Questions				
1	CO1	K1					
2	CO1	K2					
3	CO2	K1					
4	CO2	K2					
5	CO3	K1					
6	CO3	K2					
7	CO4	K1					
8	CO4	K2					
9	CO5	K1					
10	CO5	K2					
Section	B (Shoi	rt Answers)					
Answer	All Qu	estions	(5x2=10 marks)				
Q.No	СО	K Level	Questions				
11	CO1	K1					
12	CO2	K1					
13	CO3	K2					
14	CO4	K2					
15	CO5	K2					
Section	C (Eith	er/Or Type					
Answer	All Qu	estions	(5 x 5 = 25 marks)				
Q.No	CO	K Level	Questions				
16) a	CO1	K2					
16) b	CO1	K2					
17) a	CO2	K2					
17) b	CO2	K2					
18) a	CO3	K3					
18) b	CO3	K3					
19) a	CO4	K3					
19) b	CO4	K3					
20) a	CO5	K2					
20) b	CO5	K2					
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K				
levels							
Section	D (Ope	n Choice)					
Answer	Any T	hree questic	ons (3x10=30 marks)				
Q.No	CO	K Level	Questions				
21	CO1	K4					
22	CO2	K3					
23	CO3	K4					
24	CO4	K4					
25	CO5	K3					

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	OPERATIONS RESEARCH	I					
Course Code	21PMTE31			L	P	С	
Category	Category Elective						
Nature of cours	e: EMPLOYBILITY	SKILL ORIENTED	ENTREPF	RENU	RSH	IIP	
COURSE OBJ	ECTIVES:						
• To fan	niliarize various decision- ma	king tools.					
• To sol	ve optimization problems.						
To intr	oduce the application on inve	entory control system and et	с.				
• To ide	ntify the resources required fo	or a project and generate a p	lan and wo	rk sch	edul	e.	
• To lear	n about queuing models					-	
Unit: I					1	8	
Network definiti Flow Model - Cl	ons- Minimal Spanning Tree Provide Tree Provide Tree Provide Tree Provided Tree Provid	Algorithm-Shortest route p	roblem-Max	ximal			
Unit: II					1	8	
Recursive nature	of computations in DP - Forv	ward and Backward recursion	on - Selecte	d DP			
applications. Get	neral inventory models – Stati	ic Economic Order Quantity	y(EOQ) mo	dels			
Unit: III					1	8	
Decision making	under certainty-Analytic Hie	erarchy Process(AHP)-Deci	sion making	g unde	er		
Unit: IV		<u>.</u>			1	8	
Queuing systems Birth and Death Queues.	s – Elements of Queuing mode Models – Generalized Poisson	el – Role of Exponential Di n Queuing Models – Specia	stribution – llized Poisse	- Pure			
Unit: V					1	8	
Unconstrained P	roblems – Necessary and Suff	ficient Conditions- Newton	- Raphson	Meth	od -		
Constrained Pro	olems – Equality Constraints-	Inequality Constraints- Ka	rush-Kuhn-	Tucke	er		
Conditions							
		Tot	al Lecture	Hour	S	90	
Books for Stud	ly:						
Hamdy A. Taha,	Operations Research – An int	troduction, 8 th Edition, PHI, 1	New Delhi.				
Unit I- Chap	oter 6: sections 6.1 to6.5						
Unit II - Chap	ter 10: sections 10.1 to10.3						
Chap	ter 11:sections 11.1 to 11.3						
Unit III - Chap	ter 13:sections 13.1 to 13.4						
Unit IV - Chap	ter 15:sections 15.1 to 15.6						
Unit V - Chap	ter 18: sections 18.1 to18.2						
Books for Refe 1. KantiSwaru Publication	e rences: o , P.K. Gupta and Man Mohan s, Reprint 2006, NewDelhi.	n, "Operations Research", S	Sultan Chan	d & s	ons		

2. Harvey M. Wagner, "**Principles of Operations Research**", Second Edition, Prentice Hall of Pvt Ltd, 1998, NewDelhi.

3. Prem Kumar Gupta and D.S.Hira, "**Operations Research**", S.Chand Publications, 2009, New Delhi.

Web 1	Web Resources						
1.	https://nptel.ac.in/courses/111/105/111105100/						
2.	https://nptel.ac.in/courses/111/104/111104071/						
3.	http://apmonitor.com/me575/						
COURSE OUTCOMES K Le							
On the	On the successful completion of the course , the students will be able to						
CO1:	Identify various decision- making tools.	K3					
CO2:	Analyze various models in inventory system.	K4					
CO3:	Apply suitable method in game theory.	K3					
CO4:	Explain Poisson Queuing Models	K4					
CO5:	Classify the constrained and unconstrained Problems	K4					

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

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UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Network definitions- minimal spanning tree algorithm-Shortest route problem-maximal flow model - CPM and PERT.	18	Chalk & Talk
II	Recursive nature of computations in DP - Forward and Backward recursion - Selected DP applications. General inventory models – Static Economic Order Quantity(EOQ) models	18	Chalk & Talk
III	Decision making under certainty-Analytic Hierarchy Process(AHP)- Decision making under risk- decision under uncertainty-Game theory.	18	Chalk & Talk
IV	Queuing systems – Elements of Queuing model – Role of Exponential Distribution – Pure Birth and Death Models – Generalized Poisson Queuing Models – Specialized Poisson Queues.	18	Chalk & Talk,PPT
V	Unconstrained Problems – Necessary and Sufficient Conditions- Newton – Raphson Method - Constrained Problems – Equality Constraints- Inequality Constraints- Karush-Kuhn-Tucker Conditions	18	Chalk & Talk

Course Designed by:

Dr. P. Chitra Devi, Assistant Professor & Mrs. R. Sumathi Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)									
	Formative Examination - Blue Print									
		Articulation	Mapping – I	K Levels w	ith Course C	outcome	s (COs)			
			Sectio	on A	Sectior	n B	Section C	Section D		
Inte	Cos	K L ovol	MC	Qs	Short An	swers	Section C	Open		
rnal	CUS	K Level	No. of.	К-	No. of.	К-	Choico	Choico		
			Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K3	2	K1&K2	1	K1	2	1		
AI	CO2	Upto K4	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K3	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1		
	N	o. of Questions to	1		3		1	2		
Ques	ti	be asked	4		5		+	4		
on	N	o. of Questions to	1		3		2	1		
Patte	r	be answered	4		5		4	1		
n		Marks for each	1		2		5	10		
CIA	I	question	1		4		5	10		
& I	[]	Total Marks for	1		6		10	10		
		each section			U		10	10		

	Distribution of Marks with K Level CIA I & CIA II								
		Section A	Section B	Section C	Section		% of		
	K	(Multiple	(Short	(Either /	D	Total	(Marks	Consolidate	
	Level	Choice	Answer	Or	(Open	Marks	without	of %	
		Questions)	Questions)	Choice)	Choice)		choice)		
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
СТА	K3			10	10	20	40	40	
	K4			10	10	20	40	40	
1	Marks	4	6	20	20	50	100	100	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
CIA	K 3			10	10	20	40	40	
II	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course									
	Outcomes (COs)								
		K	MC	Qs	Short An	swers	Section C	Section D	
S.No	COs	I ovol	No. of	K –	No. of	K –	(Either /	(Open	
		Level	Questions	Level	Question	Level	or Choice)	Choice)	
1	CO1	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)	
2	CO2	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)	
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)	
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)	
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)	
No.	of Questi	ons to be	10		5		10	5	
	Aske	d	10		3		10	2	
No.	of Questi	ons to be	10		5		5	2	
	answer	red	10		5		5	3	
Marks for each question		1		2		5	10		
Total Marks for each		10		10		25	20		
section		10		10		25	30		
	(Figures in parenthesis denotes, questions should be asked with the given K level)								

Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %			
K1	5	4			9	7.5	22			
K2	5	6	20		31	25.7				
K3			30	20	50	41.8	42			
K4				30	30	25	25			
Marks	10	10	50	50	120	100	100			
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.									

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	СО	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K2	
16) b	CO1	K2	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K3	
18) b	CO3	K3	
19) a	CO4	K3	
19) b	CO4	K3	
20) a	CO5	K2	
20) b	CO5	K2	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questio	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K3	
22	CO2	K4	
23	CO3	K3	
24	CO4	K4	
25	CO5	K4	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	NONLINEAR DIFFERE	NTIAL EQUATIONS					
Course Code	21PMTE32			L	Р	С	
Category	y Elective 6 -						
Nature of cours	e: EMPLOYBILITY	SKILL ORIENTED	ENTREPH	RENU	RSH	IIP	
COURSE OBJ	ECTIVES:	· · · · ·					
 To form 1 To learn To under To solve To find the second second	First order Systems in Two Va Averaging Methods stand Perturbation Methods Linear Systems ne Stability of systems.	ariables and Linearization					
Unit: I					1	8	
The general pha	se plane – Some population	n models – Linear approximation	on at equili	brium	L		
points – Linear	systems in matrix form.				1	0	
Unit: II			<u>C11</u>	·	1	8	
amplitudes; Near by harmonic bala	y periodic solutions - Periodic nce – Accuracy of a period es	c solutions: Harmonic balance – l timates	Equivalent li	near e	quati	on	
Unit: III					1	8	
Outline of the dir with weak excitat pendulum equation method and Four	ect method – Forced oscillation ion – Amplitude equation for on – Lindstedt's method- Forc er series.	ons far from resonance Forced osc undamped pendulum – Amplitud red oscillation of a self – excited e	cillations nea le perturbatio equation – T	ar reso on for he Per	nance the turba	e .tion	
Unit: IV					1	8	
Structure of solut Floquet theory –	ons of the general linear syste Wronskian.	em – Constant coefficient system	– Periodic c	oeffic	ients	_	
Unit: V					1	8	
Poincare stability Comparison theorem	- Solutions, paths and norms rem for the zero solutions of n	– Liapunov stability- Stability of early-linear systems	linear syste	ms –			
		Tot	al Lecture	Hour	s 9	0	
Books for Study: "Nonlinear Ordinary Differential Equations" by D.W. Jordan and P. Smith, Clarendon Press, Oxford, 1977. Unit-I: Chapter 2; Unit-II: Chapter 4; Unit-III: Chapter 5: Sections: 5.1 - 5.4, 5.7 -5.10. Unit-IV: Chapter 8: Sections: 8.1 - 8.4; Unit-V: Chapter 9: Sections: 9.1 - 9.4, 9.6. Books for References: 1 "Differential Equations" by G.F. Simmons, Tata McGraw-Hill, New Delhi, 1979. 2 "Ordinary Differential Equations and Stability Theory" by D.A. Sanchez, Dover, New York,							
1968. 3 " Notes on N	onlinear Systems" by J.K. A	ggarwal, Van Nostrand, 1972.					
Web Resource	es s						
1. <u>https://w</u>	ww.edx.org/course/different	tial-equations-2x2-systems					

2. 3.	https://www.studocu.com/en-gb/document/teesside-university/methods-for-non-linear- mathematics/lecture-notes-course-math1133-nonlinear-differential-equations/135452 https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/video-					
	lectures/lecture-31-non-linear-autonomous-systems/					
COUF	COURSE OUTCOMES K Level					
On the	e successful completion of the course , the students will be able to					
CO1:	Understand the dynamics of basic population models	K2				
CO2:	Find approximate solutions of nonlinear equations using averaging and perturbation methods	К3				
CO3:	Master the concepts of stability in different perspectives	K4				
CO4:	Have an idea on qualitative properties of solutions of linear and nonlinear systems	K2				
CO5:	Improve their problem solving capabilities	K3				

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	1
CO 3	3	3	3	1	1	-
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	The general phase plane – Some population models – Linear approximation at equilibrium points – Linear systems in matrix form.	18	Chalk & Talk
П	An energy balance method for limit cycles – Amplitude and frequency estimates – Slowly varying amplitudes; Nearly periodic solutions - Periodic solutions: Harmonic balance – Equivalent linear equation by harmonic balance – Accuracy of a period estimate.	18	Chalk & Talk
III	Outline of the direct method – Forced oscillations far from resonance Forced oscillations near resonance with weak excitation – Amplitude equation for undamped pendulum – Amplitude perturbation for the pendulum equation – Lindstedt's method- Forced oscillation of a self – excited equation – The Perturbation method and Fourier series.	18	Chalk & Talk
IV	Structure of solutions of the general linear system – Constant coefficient system – Periodic coefficients – Floquet theory – Wronskian.	18	Chalk & Talk
V	Poincare stability – Solutions, paths and norms – Liapunov stability- Stability of linear systems – Comparison theorem for the zero solutions of nearly-linear systems	18	Chalk & Talk

Course Designed by:

Dr. M. Saravanan, Assistant Professor & Mrs. S. Ragavi, Assistant Professor

Learning Outcome Based Education & Assessment (LOBE)										
	Formative Examination - Blue Print									
		Articulation	Mapping –	K Levels w	vith Course C	Jutcome	s (COs)			
			Sectio	on A	Section	B	Section C	Section D		
Inte	Cos	K I ovol	MC	Qs	Short Ans	swers	Fither or	Open		
rnal	CUS	K Level	No. of.	К-	No. of.	К-	Choico	Choico		
			Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1		
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1		
		No. of	4							
		Questions to			3		4	2		
		be asked								
		No. of								
Que	stion	Questions to	4		3		2	1		
Pat	tern	be answered								
CIA	I & II	Marks for	1		2		5	10		
		each question	1		2		5	10		
		Total Marks								
		for each	4		6		10	10		
		section								

	Distribution of Marks with K Level CIA I & CIA II									
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
	K4			10	10	20	40	40		
1	Marks	4	6	20	20	50	100	100		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
II	K4			10	10	20	40	40		
	Marks	4	6	20	20	50	100	100		

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course								
	Outcomes (COs) MCOs Short Answers Section C Section D							
S No	COs	К -	No of	V9 K -	No of	K_	(Fither /	(Open
5.110	005	Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K2&K2)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No.	of Questi Aske	ons to be d	10		5		10	5
No. of Questions to be answered		No. of Questions to be answered			5		5	3
Marks for each question		1		2		5	10	
Total Marks for each section		10		10		25	30	
	(Figures	in parenthe	sis denotes,	questions s	hould be as	ked with	n the given K	level)

Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %			
K1	5	4			9	7.5	17			
K2	5	6			11	9.17	17			
K3			25	20	45	37.5	37			
K4			25	30	55	45.83	46			
Marks	10	10	50	50	120	100	100			
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels									

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	СО	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K2	
16) b	CO1	K2	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K3	
18) b	CO3	K3	
19) a	CO4	K4	
19) b	CO4	K4	
20) a	CO5	K2	
20) b	CO5	K2	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any T	hree questio	ns (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K4	
24	CO4	K2	
25	CO5	K3	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name STATISTICS								
Course Code 21PMTE33	L	Р	С					
Category Elective	6	-	6					
Nature of course: EMPLOYBILITY SKILL ORIENTED ENTREPE	RENU	RSH	IIP					
COURSE OBJECTIVES:								
 To develop knowledge on random variables. To develop knowledge on various standard distributions. To introduce Sampling Theory. To familiarize the application through various statistical methods. To create statistical models for real life problems. 								
Unit: I		1	8					
Set theory, Probability set function, Conditional probability and Independe variables of the discrete type, Random Variables of the continuous type, Pr distribution function, Expectation of a Random variable, Some special e Chebyshev's inequality.	nce , opert	Ran ies o ation	idom f the is , 8					
Distributions of random variables, Conditional distributions and expectations, T	he co	rrelat	tion					
coefficient, Independent random variables, Extension to several random variables.		1	0					
The Binomial and Related distributions The Poisson distribution The Gamma a	nd Cł	1	0 Liare					
distribution, The Normal distribution, The Bivariate normal distribution.		n-squ	uare					
Unit: IV		1	8					
Sampling theory, Transformations of variables of the discrete type, Transformation of the continuous type, The Beta, t, F distributions, Extensions of the change technique, The moment generating function technique, Some Specific distributions of \overline{X} and $\frac{ns^2}{\sigma^2}$, Expectation of functions of Random Variables.	ns of ge of bution	varia f var 1s -	ables iable The					
Unit: V		1	8					
Convergence of distribution, Convergence of probability, Limiting mome functions, the Central limit theorem, Some theorems of limiting distributions.	ent g	genera	ating					
Books for Study	Hour	's 9	0					
 Books for Study R.V. Hogg and A.T.Craig, Introduction to Mathematical Statistics, Fifth Edition Education, New Delhi, 2005. Unit I - Chapter 1 : Sections 1.1 to 1.10 Unit II - Chapter 2 : Sections 2.1 to 2.5 	ı, Pea	rson						
Unit III - Chapter 3 : Sections 3.1 to 3.5 Unit IV - Chapter 4 : Sections 4.1 to 4.9 Unit V - Chapter 5 : Sections 5.1 to 5.5								
Books for References:								

	1. Irwin Miller, Mathematical Statistics, Pearson Publisher, 2004.	
	2. David Freeman, Statistics , Viva Book Publisher, 2010.	
	3. R.S.N.Pillai & Bagavathy ,Statistics Theory and Practice, S.Chand Publication	ons,
	7 th Revised Edition ,2008.	
Web F	Resources	
1.	http://users.encs.concordia.ca/~doedel/courses/comp-233/slides.pdf	
2.	https://www.mrecacademics.com/DepartmentStudyMaterials/20210624-80B0	<u>9-</u>
	%20PROBABILITY%20AND%20STATISTICS.pdf	
3.	https://www.brainkart.com/subject/Probability-and-Statistics_395/	
COUR	RSE OUTCOMES	K Level
On the	e successful completion of the course , the students will be able to	
CO1.	Select the concepts of Probability theory and Mathematical	V2
COI	Statistics.	КJ
	Apply properties of Random variables Moments, Characteristic function,	
CO2:	Binomial distribution, Poisson distribution, Normal distribution, and Stochastic	K3
	Convergence.	
CO2.	Solve today's complex world problems by applying the concepts	K3
005:	obtained in the course	КJ
	Analyse mean, variance, moments for various distributions using Characteristic	
CO4:	function, Probability Generating function, One point distribution and Two point	K4
	distribution	
CO5:	Derive various distributions and prove the theorems on Stochastic Convergence	K4

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON	PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
I	Set theory, Probability set function, Conditional probability and Independence, Random variables of the discrete type, Random Variables of the continuous type, Properties of the distribution function, Expectation of a Random variable, Some special expectations, Chebyshev's inequality.	18	Chalk & Talk, PPT
II	Distributions of random variables, Conditional distributions and expectations, The correlation coefficient, Independent random variables, Extension to several random variables.	18	Chalk & Talk
III	The Binomial and Related distributions, The Poisson distribution, The Gamma and Chi-square distribution, The Normal distribution, The Bivariate normal distribution.	18	Chalk & Talk
IV	Sampling theory, Transformations of variables of the discrete type, Transformations of variables of the continuous type, The Beta, t, F distributions, Extensions of the change of variable technique, The moment generating function technique, Some Specific distributions - The distributions of \bar{X} and $\frac{ns^2}{\sigma^2}$, Expectation of functions of Random Variables.	18	Chalk & Talk, PPT
V	Convergence of distribution, Convergence of probability, Limiting moment generating functions, the Central limit theorem, Some theorems of limiting distributions.	18	Chalk & Talk

Course Designed by:

Dr. R. Bhavani, Assistant Professor & Mrs. R. Sumathi, Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)										
	Formative Examination - Blue Print										
	Articulation Mapping – K Levels with Course Outcomes (COs)										
			Section A		Section B		Section C	Section D			
Inte	Cos	K L ovol	MC	Qs	Short Answers		Fither or	Open			
rnal	CUS	K Level	No. of.	К -	No. of.	К-	Choico	Choico			
			Questions	Level	Questions	Level	Choice	Choice			
CI	CO1	Upto K3	2	K1&K2	1	K1	2	1			
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1			
CI	CO3	Upto K3	2	K1&K2	1	K2	2	1			
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1			
		No. of									
		Questions to	4		3		4	2			
		be asked									
		No. of									
Que	stion	Questions to	4		3		2	1			
Pat	tern	be answered									
CIA	I & II	Marks for	1		2		5	10			
		each question	1		2		5	10			
		Total Marks									
		for each	4		6		10	10			
		section									

		D	istribution of	Marks wit	h K Level (CIAI&(CIA II		
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
СТА	K3			10	10	20	40	40	
	K4			10	10	20	40	40	
1	Marks	4	6	20	20	50	100	100	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
CIA	K3			10	10	20	40	40	
II	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course										
				Outcomes	(COs)						
		V	MC	Qs	Short An	swers	Section C	Section D			
S.No	COs	K - Level	No. of	K –	No. of	K –	(Either /	(Open			
			Questions	Level	Question	Level	or Choice)	Choice)			
1	CO1	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)			
2	CO2	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)			
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)			
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)			
5	CO5	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)			
No. o	of Quest	ions to be	10		5		10	5			
	Aske	d	10		5		10	5			
No. o	of Quest	ions to be	10		5		5	3			
	answe	red	10		3		5	5			
Marks for each question			1		2		5	10			
Total Marks for each		10		10		25	20				
	sectio	on	10		10		25				
	(Figure	s in parenth	esis denotes,	questions s	hould be as	ked with	n the given K	level)			

		D	istribution of	Marks with	K Level		
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	4			9	7.5	22
K2	5	6	20		31	25.8	
K3			30	30	60	50	50
K4				20	20	16.7	17
Marks	10	10	50	50	120	100	100
NB: Hig	gher level of p	erformance o	of the student	s is to be asse	essed by a	attempting	higher level
of K lev	els.						

Section	A (Mu	ltiple Cho	ice Questions)					
Answei	r All Q	uestions	(10x1=10 marks)					
Q.No	CO	K Level	Questions					
1	CO1	K1						
2	CO1	K2						
3	CO2	K1						
4	CO2	K2						
5	CO3	K1						
6	CO3	K2						
7	CO4	K1						
8	CO4	K2						
9	CO5	K1						
10	CO5	K2						
Section	B (Sho	ort Answer	rs)					
Answei	r All Q	uestions	(5x2=10 marks)					
Q.No	CO	K Level	Questions					
11	CO1	K1						
12	CO2	K1						
13	CO3	K2						
14	CO4	K2						
15	CO5	K2						
Section	C (Eit	her/Or Ty	pe)					
Answei	r All Q	uestions	(5 x 5 = 25 marks)					
Q.No	CO	K Level	Questions					
16) a	<u>CO1</u>	K2						
16) b	COI	K2						
17) a	<u>CO2</u>	K2						
17) b	<u>CO2</u>	K2						
18) a	<u>CO3</u>	K3						
18) b	<u>CO3</u>	K3						
19) a	<u>CO4</u>	K3 K2						
19) b	$\frac{CO4}{CO5}$	K3 K2						
20) a	<u>C05</u>	K3 K2						
20) b	<u> </u>	K3						
NB: HI	gner le	vel of perio	ormance of the students is to be assessed by attempting higher					
level of	N leve	is or Chaine						
Answer	Section D (Upen Unoice)							
O No		K L ovol	Ouestions (JX10=50 IIIarKS)					
21	$\frac{0}{0}$	K3	Questions					
$\frac{21}{22}$	$\frac{CO1}{CO2}$	K3						
22	$\frac{CO2}{CO3}$	K3						
23	$\frac{CO3}{CO4}$	K/						
2 4 25	$\frac{CO4}{CO5}$	K/						
23	COS	<u>N</u> 4						

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	INT	EGRAL EQUATIONS							
Course Code	21P	1TE34			L	Р	С		
Category	Elec	ive			6	-	6		
Nature of cours	se:	EMPLOYABILITY S	SKILL ORIENTED	ENTREPF	RENI	JRSH	IIP		
COURSE OBJ	ECT	VES:							
To famili	arize	ne key concept of popular and use	seful transformations						
• To solve	ordina	y differential equations with diff	ferent forms of initial ar	nd boundary	cond	itions.			
• To under	stand	ne relationship between integral a	and differential equation	ns.					
• To famili	arize	redholm theory							
• To apply	<i>inte</i>	ral equation in various transfor	ormations				0		
Regularity cond	itions	– Special kinds of Kernels – E	Eigen values and Eige	n functions	-Cc	nvolu	ution		
Integral – The In	nner (Scalar Product of Two Funct	t_{10} = Reduction to a	System of	Alge	braic			
Equations – Free	anoin	Alternatives – An Approxima	ate Method			1	0		
	•	A		V 1/ T			8		
Method of Succ	essiv	Approximations – Iterative So	cneme – Examples –	volterra In	tegra	I Equ	ation		
– Examples – So	ome I	esuits about the Resolvent Ker	rnel.			1	0		
Classical Eradh	_1	norm The Method of Colut	tion of Englholm E	undhalma'a	finat	1	0		
examples - Fredholm's second theorem - Fredholm's third theorem									
Unite IV	1110111	s second theorem – Fredholm				1	0		
Applications of ordinary differential equations initial value problems boundary value problems									
Applications of	irac d	Its function Green's function	n approach avample	- OOunuar y	value	; proc	nems		
- examples - Dirac denta function - Green's function approach - examples.									
Integral transfo	rmati	n methods – introduction	– Fourier transform	– Lanlac	e tra	ansfor	·m _		
application to V	olteri	integral equations with Conv	volution type kernels –	- examples	C 111	115101	111		
	011011	integral equations with conv	Tot	al Lecture	Нон	rs 9	0		
Books for Stu	dv۰		100		nou	15 2	•		
Linear Integra	uy. I Eai	ations: Theory & Techniqu	ie (Second Ed.) by 1	Ram P Ka	nwal	Spr	inger		
Science & Busin	ess N	edia 2013		I (uiii I , I)(u		, opi	inger		
Unit 1: Chapter	1 full	chapter 2.1 to 2.5							
Unit 2: Chapter	3 full	I. I							
Unit 3: Chapter	4 full								
Unit 4: Chapter	5.1 to	5.6							
Unit 5: Chapter	9.1 to	9.5.							
Books for Ref	eren	es:							
1) Raishinghani	ia M.). Integral equation & Bou	undary value proble	em, S. Cha	nd p	oublis	hing,		
2007.									
2) Jerri, A. Introduction to integral equations with applications, John Wiley & Sons, 1999.									
3) Hildebrand, H	3) Hildebrand, F.B. Method of applied Mathematics, Courier corporation, 2012								
Web Resource	es								
1. <u>https://nptel.a</u>	ac.in/	ourses/111/107/111107103/							
2. <u>https://www.</u>	yout	be.com/watch?v=WPlBrzjI1	<u>lKI&list=PLq-Gm0y</u>	<mark>yRYwTiPq</mark>	4ypI	E6cP-	<u>1-</u>		
UqSHO5pia&i	ndex	3							

3. http://www.mcs.st-and.ac.uk/~rac/MT5802/Integral%20equations.pdf						
COUR	SE OUTCOMES	K Level				
On the	e successful completion of the course , the students will be able to					
CO1:	Explain various types of kernels	K4				
CO2:	Solve linear Volterra and Fredholm integral equations using appropriate methods	K3				
CO3:	Formulate complex problems of ordinary and partial differential equations with techniques of Integral transform	K4				
CO4:	Apply integrals equation in transforms	K3				
CO5:	Determine a wide range of differential and integral equations by Fourier transforms	K4				

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
I	Regularity conditions – Special kinds of Kernels – Eigen values and Eigen functions – convolution integral – the inner or scalar product of two functions – Reduction to a system of algebraic equations – Fredholm alternatives – An approximate method	18	Chalk & Talk
II	Method of Successive approximations – iterative scheme – examples – Volterra integral equation – examples – Some results about the resolvent Kernel.	18	Chalk & Talk
III	Classical Fredholm theory – the method of solution of Fredholm – Fredholm's first theorem – examples – Fredholm's second theorem – Fredholm's third theorem.	18	Chalk & Talk
IV	Applications of ordinary differential equations – initial value problems – boundary value problems – examples – Dirac delta function – Green's function approach – examples.	18	Chalk & Talk
V	Integral transformation methods – introduction – Fourier transform – Laplace transform – application to Volterra integral equations with Convolution type kernels – examples.	18	Chalk & Talk

Course Designed by:

Dr. M. Saravanan, Assistant Professor & Dr. S. Andal, Assistant Professor

Learning Outcome Based Education & Assessment (LOBE)

	Formative Examination - Blue Print Articulation Mapping K Loyals with Course Outcomes (COs)										
		Articulatio	n Mapping - Secti	on A	Section B						
Inte	~		MCOs		Short Answers		Section C	Section D			
rnal	Cos	K Level	No. of.	K - Level	No. of.	K -	 Either or Choice 	Open Choice			
			Questions		Questions	Level					
CI	CO1	Upto K4	2	K1&K2	1	K1	2	1			
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1			
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1			
AII	CO4	Upto K3	2	K1&K2	2	K2	2	1			
Question Pattern CIA I & II		No. of Questions to be asked	4		3		4	2			
		No. of Questions to be answered	4		3		2	1			
		Marks for each question	1		2		5	10			
		Total Marks for each section	4		6		10	10			

		D	istribution of	Marks wit	h K Level (CIAI&(CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course										
				Outcomes	(COs)						
		V	MC	Qs	Short An	swers	Section C	Section D			
S.No	COs	K - Level	No. of	K –	No. of	K –	(Either / or	(Open			
			Questions	Level	Question	Level	Choice)	Choice)			
1	CO1	Upto K4	2	K1&K2	1	K1	2(K2&K2)	1(K4)			
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)			
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)			
4	CO4	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)			
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)			
No. (of Quest	ions to be	10		5		10	5			
	Aske	a									
No. (of Quest	ions to be	10		5		5	3			
	answe	red	10		C		C	C			
Marks for each question			1		2		5	10			
Total Marks for each		10		10		25	30				
	sectio	on	10		10		25	30			
	(Figures	s in parenth	esis denotes,	questions	should be a	sked wit	th the given K	level)			

	Distribution of Marks with K Level									
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %			
K1	5	4			9	7.5	22			
K2	5	6	20		31	25.8				
K3			30	20	50	41.7	42			
K4				30	30	25	25			
Marks	10	10	50	50	120	100	100			
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.										

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	COI	K2	
16) b	COI	K2	
17) a	CO2	K3	
1/)b	CO2	K3	
18) a	CO3	K3	
18) b	CO3	K3 K2	
19) a	CO4	K3 K2	
19) b	C04	K3 K2	
20) a	C05	K2 K2	
20) D	<u> </u>	K2	manaa af tha students is to be assessed by attempting higher level of V
ND: HIg	gner lev	el ol perior	mance of the students is to be assessed by attempting higher level of K
Section	D (One	n Choice)	
Answer	Any TI	n Chuice) hree questio	(3x10-30 marks)
O.No	CO	K Level	Ouestions
21	CO1	K4	Zuotono
22	CO2	K3	
23	CO3	K4	
24	CO4	K3	
25	CO5	K4	
-			

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	CRYPTOGRAPHY						
Course Code	21PMTE35			L	Р	С	
Category	Elective			6	-	6	
Nature of							
course:	EMPLOYABILITY	SKILL ORIENTED	ENTREP	'KEN	EUR:	SHIP	
COURSE OBJECTIVES:							
To learn about M	athematics of Crypotogrph	V					
To get the Key ci	inhers	J					
To understand the	e need for the modern strea	m cinhers					
To know about D	ata Encryption Standard	in cipitors					
To know about A	duanced Energy tion Standard	arda					
	dvanced Encryption Standa	11105		18			
UIIII: I Socurity gools Cr	entographia attacka Mathama	tion of Cruntography. Intog		Mo	Jular		
arithmetic Matrice	piographic attacks –Mathema	ands of Cryptography: Intege	er aritinnetic	-10100	Jular		
Unit. II	es-Emear congruence.			18			
Traditional symme	etric-Key ciphers: Introductio	n_Substitution ciphers-Tran	sposition cir	hers-	- Strea	m and	
block ciphers	the Rey explicits. Introductio	ii Substitution cipiters-rran	sposition ei	11013	51100	ini and	
Unit: III				18			
Mathematics of sy	mmetric – Key cryptography:	Algebraic structures –GF(2	2n)Fields .Int	rodu	ction to	С	
modern symmetric – Key ciphers: Modern block ciphers – Modern stream ciphers							
Unit: IV				18			
Data Encryption	Standard (DES): Introduction	n – DES structure – DES	analysis –S	ecurit	y of l	DES –	
Multiple DES (Cor	nventional Encryption Algorit	hms) – Examples of block c	iphers influe	enced	by DE	ES	
Unit: V				18			
Advanced Encrypt	ion Standard (AES) Transform	nations–Key expansion– T	The AES Ci	phers	<u>s</u> —		
Examples– Analy	ysis of AES.						
		Total Lee	cture Hours	90			
Books for Study:			1.0	·	012		
Benrouz Forouzan	A and Debdeep Muknopadny	ay, "Cryptography and Net	work Securi	u y ~ 2	013,		
Unit I·Chapter1-Se	ection 1 1-1 4 Chapter? Secti	on-2 1-2 4					
UnitII:Chapter-3-	Section-3 1-3 4	011-2.1-2.7					
UnitIII:Chapter 4-	Section-4.1-4.2.Chapter5.Sect	ion-5.1-5.2					
UnitIV :Chapter6-	Section-6.1-6.6						
UnitV:Chapter7-S	ection-7.1-7.6						
Books for Referen	nces:						
1.Atul Kahate,2014	4, Cryptography and Netwo	rk Security, Third Edition,	McGraw Hi	i11			
Education(India) P	Private Limited, New Delhi.						
2.Bruce Schneier,2	2012, Applied Cryptography	: Protocols, Algorithms an	d Source co	de in	н С ,		
2 ^{me} Edition, Wiley In	ndia, New Delhi.						
5.Statings,2013,C	ryptograpny and Network S	ecurity,: Principles and Pi	actice, Sixt	n Edi	uon, P	earson	
New Delhi India	Education, New Delbi India						
Web Resources							
https://cseweb.u	csd.edu/~mihir/naners/oh	ndf					
https://www.res	earchgate.net/nublication	/2859322 Notes on Crv	ntogranhv				

http://www.cse.iitd.ac.in/~shweta/notes/Lec1.pdf					
COURS	COURSE OUTCOMES K Level				
On the	successful completion of the course, the students will be able to				
CO1	Demonstrate the understanding the fundamentals of cryptography	K2			
CO2	Demonstrate standard cryptographic Algorithms used to analyze confidentiality, integrity and authenticity.	K2			
CO3	List the security issues in the network, key distribution and management schemes	K4			
CO4	Explain in detail about Data encryption standard(DES)Structure	K4			
CO5	Analyze the Advanced Encryption standard(AES)	K4			

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Security goals–Cryptographic attacks–Services and mechanism Techniques. Mathematics of Cryptography: Integer arithmetic–Modular arithmetic–Matrices–Linear congruence.	18	Chalk & Talk
п	Traditional symmetric–Key ciphers: Introduction Substitution ciphers-Transposition ciphers– Stream and block ciphers	18	Chalk & Talk
III	Mathematics of symmetric – Key cryptography: Algebraic structures – GF(2 <i>n</i>)Fields Introduction to modern symmetric – Key ciphers: Modern block ciphers – Modern stream ciphers	18	Chalk & Talk
IV	Data Encryption Standard (DES): DES structure – DES analysis –Security of DES – Multiple DES (Conventional Encryption Algorithms) – Examples of block ciphers influenced by DES	18	Chalk & Talk
V	Advanced Encryption Standard(AES) Transformations– Key expansion– The AES Ciphers– Examples– Analysis of AES.	18	Chalk & Talk

Course Designed by:

Dr. A. Arivu Chelvam, Assistant Professor & Dr. V. Ramachandran Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)								
	Formative Examination - Blue Print								
		Articulation	Mapping –	K Levels w	vith Course C	Jutcome	s (COs)		
			Sectio	Section A		Section B		Section D	
Inte	K L ovol	MC	Qs	Short Ans	swers	Fither or	Open		
rnal	CUS	K Level	No. of.	К-	No. of.	К-	Choice	Choice	
		Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1	
AI	CO2	Upto K2	2	K1&K2	2	K2	2	1	
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1	
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1	
		No. of Questions to be asked	4		3		4	2	
Question Pattern CIA I & II		No. of Questions to be answered	4		3		2	1	
		Marks for each question	1		2		5	10	
		Total Marks for each section	4		6		10	10	

		D	istribution of	Marks wit	h K Level (CIAI& C	CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
L	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
Π	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
				Outcomes	(COS) Short Ar		Section C	Seation D
		К-	MC	Qs	Snort An	iswers	Section C	Section D
S.No	COs	I ovol	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K2&K2)	1(K2)
2	CO2	Upto K2	2	K1&K2	1	K1	2(K2&K2)	1(K2)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
5	CO5	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
No.	of Questi	ons to be	10		5		10	5
	Aske	d	10		5		10	5
No.	of Questi	ons to be	10		5		5	2
	answer	red	10		5		5	3
Mark	ks for eacl	h question	1		2		5	10
Tot	al Marks	for each	10		10		25	20
	section		10		10		25	30
	(Figures	in parenthe	esis denotes,	questions s	hould be as	ked with	n the given K	level)

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	17		
K2	5	6			11	9.17	17		
K3			25	20	45	37.5	37		
K4			25	30	55	45.83	46		
Marks	10	10	50	50	120	100	100		
NB: Hig	gher level of p	erformance o	of the students	s is to be asso	essed by a	attempting	higher level		

NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.

Section	A (Mu	ıltiple Cho	ice Questions)
Answei	r All Q	uestions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Sho	ort Answei	rs)
Answei	r All Q	uestions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eit	her/Or Ty	pe)
Answei	r All Q	uestions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	COI	K2	
16) b	COI	K2	
1/) a	CO2	K2	
1/)b	CO2	K2	
18) a	CO3	K3 K2	
18) b	CO3	K3 K2	
19) a	CO4	K3 K2	
19) b	CO4	K3 K2	
20) a	C05	K3 K2	
20) D	<u> </u>	<u> </u>	
NB: HI	gner le	vel of peri	ormance of the students is to be assessed by attempting higher
Section	\mathbf{R} leve	an Chaice	
Answei	r Anv T	Three ques) tions (3x10-30 marks)
		K Loval	Ouestions
21	CO1	K?	<u>Yutsuons</u>
22	CO^{1}	K2 K2	
23	CO3	K4	
23	CO4	K4	
25	CO5	K4	
25	005	117	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	MATHEMATICAL MOI	DELLING					
Course Code	21PMTE36			L	Р	С	
Category	Elective			6	-	6	
Nature of cours	e: EMPLOYBILITY	SKILL ORIENTED	ENTREPH	RENU	RSH	IIP	
COURSE OBJ	ECTIVES:						
 To understand the need for mathematical modelling To know the modelling in First order Ordinary Differential Equations To apply the modelling in Second order Ordinary Differential Equations To know Models for Blood Flows using Fluid Dynamics To apply Models for Optimal Control of Water Pollution 							
Unit: I					1	8	
Mathematical Modeling: Need, Techniques, Classifications and Simple Illustrations: Simple Situations Requiring Mathematical Modeling - The Technique of Mathematical Modeling - Classification of Mathematical Models - Some Characteristics of Mathematical model Mathematical Modeling Through Ordinary Differential Equations of First Order Mathematical Modeling Through Differential Equations - Linear Growth and Decay Models							
Unit: II	¥	•			1	8	
Mathematical M Mathematical M Systems of Or Systems of Ord	Mathematical Modeling Through Systems of Ordinary Differential Equations of First Order Mathematical Modeling in Population Dynamics - Mathematical Modeling of Epidemics Through Systems of Ordinary Differential Equations of First Order - Compartment Models Through Systems of Ordinary Differential Equations – Mathematical Modeling in Economics Through Systems of Ordinary Differential Equations of First Order						
Unit: III					1	8	
Mathematical M Mathematical M Systems of Ordi Mathematical M Modeling of P Satellites	Mathematical Modeling Through Systems of Ordinary Differential Equations of First Order Mathematical Models in Medicine, Arms Race, Battles and International Trade in Terms of Systems of Ordinary Differential Equations Mathematical Modeling Through Ordinary Differential Equations of Second Order Mathematical Modeling of Planetary Motions - Mathematical Modeling of Circular Motion and Motion of						
Unit: IV					1	8	
Unit: IV 18 . Some Basic Concepts of Fluid Dynamics - Basic Concepts about Blood, Cardiovascular System and Blood Flows - Steady Non-Newtonian Fluid Flows in Circular Tubes - Basic Equations for Fluid Flow - Flow of Power-law Fluid in Circular Tube - Flow of Herschel-Bulkley Fluid in Circular Tube - Flow of Casson Fluid in Circular Tube – Flow of Immiscible Power-law Fluids in a Circular Tube - Blood Flow through Artery with Mild Stenosis							
Water Quality	Management Models - Wa	ater Quality Management N	Iodel 1 –	Wate	r Or	ality	
Management M 4 - Other Mode Optimal Air Pol Control Model	odel 2 - Water Quality Man els for Water Quality Man lution Control Models - Co	agement Model 3 - Water Quanty Annuagement W agement - Other Optimal Po ntrol Models for Solid Waste	uality Mana ollution Co e Disposal 1	ntrol Noise	ent M Mod Polli	Iodel lels - ution	

	Total Lecture Ho	urs 90					
Books for Study:							
1. J. N.	1. J. N. Kapur - Mathematical modeling, New Age International (P) Limited, Publishers, New						
Delhi, First Edition							
Unit I - Chapter 1							
Unit II – Chapter 2							
Unit III – Chapter 2							
2. J. N. Kapur - Mathematical Models in Biology & Medicine Affiliated East-West Press Private							
Limited, New Delhi.							
Unit IV – Chapter 3							
Unit V – Chapter 4							
Books for References:							
1 D.N. Burghes - Modeling through Differential Equation, Ellis Horwood and JohnWiley.							
2. C. Dyson and E. Levery, Principle of Mathematical Modeling, Academic Press							
NewYork.							
3. Giordano, Weir, Fox, A First Course in Mathematical Modeling 2nd Edition,							
Brooks/Cole Publishing Company, 1997.							
4. B. Barnes, G. R. Fulford, Mathematical Modeling with Case Studies, A							
DifferentialEquation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis							
group,London and New York,							
Web Resources							
1. <u>https://www.mat.univie.ac.at/~neum/model.html</u>							
2. <u>https://nptel.ac.in/courses/111/107/1111071</u>							
3. <u>https://www.frontiersin.org/articles/10.3389/fgene.2015.00354/full</u>							
COURSE OUTCOMES K Level							
On the successful completion of the course , the students will be able to							
CO1:	Use differential equations in solving mathematical models.	K3					
CO2:	Analyze the Occurrence, classification and characteristics of Mathematical	K/					
	Models.	N4					
CO3:	Apply problem solving techniques in Mathematical Modeling to bring	V2					
	solutions to various real life situations.	КJ					
CO4:	Examine the principles governing the motion of satellites through notions of	K4					
	Mathematical Modeling and interpret the techniques in Mathematical Models						
	to analyse the motion of fluids.						
CO5:	Explain suitable models for population dynamics, medicine and reducing	K3					
	various forms of Pollution	КJ					

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level
LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Mathematical Modeling: Need, Techniques, Classifications and Simple Illustrations: Simple Situations Requiring Mathematical Modeling - The Technique of Mathematical Modeling - Classification of Mathematical Models - Some Characteristics of Mathematical model Mathematical Modeling Through Ordinary Differential Equations of First Order Mathematical Modeling Through Differential Equations - Linear Growth and Decay Models - Non-Linear Growth and Decay Models - Compartment Models	18	Chalk & Talk
п	Mathematical Modeling Through Systems of Ordinary Differential Equations of First Order Mathematical Modeling in Population Dynamics - Mathematical Modeling of Epidemics Through Systems of Ordinary Differential Equations of First Order - Compartment Models Through Systems of Ordinary Differential Equations – Mathematical Modeling in Economics Through Systems of Ordinary Differential Equations of First Order	18	Chalk & Talk
III	Mathematical Modeling Through Systems of Ordinary Differential Equations of First Order Mathematical Models in Medicine, Arms Race, Battles and International Trade in Terms of Systems of Ordinary Differential Equations Mathematical Modeling Through Ordinary Differential Equations of Second Order Mathematical Modeling of Planetary Motions - Mathematical Modeling of Circular Motion and Motion of Satellites	18	Chalk & Talk
IV	Models for Blood Flows Some Basic Concepts of Fluid Dynamics - Basic Concepts about Blood,Cardiovascular System and Blood Flows - Steady Non-Newtonian Fluid Flows in Circular Tubes - Basic Equations for Fluid Flow - Flow of Power-law Fluid in Circular Tube - Flow ofHerschel-Bulkley Fluid in Circular Tube - Flow of Casson Fluid in Circular Tube – Flow of Immiscible Power-law Fluids in a Circular Tube - Blood Flow through Artery with Mild Stenosis	18	Chalk & Talk
V	Models for Optimal Control of Water Pollution Water Quality Management Models - Water Quality Management Model 1 – Water Quality Management Model 2 - Water Quality Management Model 3 - Water Quality Management Model 4 - Other Models for Water Quality Management - Other Optimal Pollution Control Models - Optimal Air Pollution Control Models - Control Models for Solid Waste Disposal Noise Pollution Control Model	18	Chalk & Talk

Course Designed by: Dr. V. Ramachandran Assistant Professor & **Dr. A. Hamari Choudhi,** Head & Associate Professor

	Learning Outcome Based Education & Assessment (LOBE)										
	Formative Examination - Blue Print										
	1		Articulation	Mapping –	K Levels w	th Course O	utcomes	(COs)			
				Section	on A	Section	B	Section C	Section		
Inte	Co	G	K L ovol	MC	Qs	Short Ans	wers	Fithon on	D		
rnal Co	CO	5	K Level	No. of.	V Larval	No. of.	K -	Choice	Open		
				Questions	K - Level	Questions	Level	Choice	Choice		
CI	CO	1	Upto K3	2	K1&K2	1	K1	2	1		
AI	CO	2	Upto K4	2	K1&K2	2	K2	2	1		
CI	CO	3	Upto K3	2	K1&K2	1	K2	2	1		
AII	CO	4	Upto K4	2	K1&K2	2	K2	2	1		
0		N	lo. of Questions to be asked	4		3		4	2		
Ques n	5110	N t	lo. of Questions to be answered	4		3		2	1		
CIA I	I &	ľ	Marks for each question	1		2		5	10		
		Γ	Total Marks for each section	4		6		10	10		

		D	istribution of	Marks wit	h K Level (CIAI&(CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course									
			MC	Outcomes Os	Short A	nswers	Section C	Section D		
S.No	COs	K - Level	No. of	K –	No. of	K –	(Either /	(Open		
			Questions	Level	Question	Level	or Choice)	Choice)		
1	CO1	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)		
2	CO2	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)		
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)		
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)		
No.	of Ques Ask	tions to be ed	10		5		10	5		
No.	of Ques answe	tions to be ered	10		5		5	3		
Marks for each question		1		2		5	10			
Total Marks for each section		10		10		25	30			
	(Figure	es in parenth	esis denotes.	questions	should be a	sked with	the given K l	evel)		

	Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %				
K1	5	4			9	7.5	22				
K2	5	6	20		31	25.8					
K3			30	30	30	25	25				
K4				20	20	16.7	17				
Marks	10	10	50	50	120	100	100				
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.										

Section	A (Mul	tiple Choice	e Questions)				
Answer	All Qu	estions	(10x1=10 marks)				
Q.No	CO	K Level	Questions				
1	CO1	K1					
2	CO1	K2					
3	CO2	K1					
4	CO2	K2					
5	CO3	K1					
6	CO3	K2					
7	CO4	K1					
8	CO4	K2					
9	CO5	K1					
10	CO5	K2					
Section	B (Shor	rt Answers)					
Answer	All Qu	estions	(5x2=10 marks)				
Q.No	CO	K Level	Questions				
11	CO1	K1					
12	CO2	K1					
13	CO3	K2					
14	CO4	K2					
15	CO5	K2					
Section	C (Eith	er/Or Type					
Answer	All Qu	estions	(5 x 5 = 25 marks)				
	<u>CO</u>	K Level	Questions				
16) a	C01	K2					
16) b	C01	K2					
1/)a	CO2	K3 K2					
1/) D	CO_2	K3 K2					
10) a	CO_3	K3 K2					
18) 0	C03	K3 K2					
19)a	C04	K3 K2					
$\frac{19}{0}$	C04	K3 K2					
20) a	CO5	K2 K2					
20) 0 NR• Hi	ther lev	ol of perfor	mance of the students is to be assessed by attempting higher level of K				
levels			mance of the students is to be assessed by attempting higher level of K				
Section	D (One	n Choice)					
Answer	Answer Any Three questions (3v10-30 marks)						
Q.No	CO	K Level	Questions				
21	CO1	K3					
22	CO2	K4					
23	CO3	K3					
24	CO4	K4					
25	CO5	K3					

Summative Examinations - Question Paper – Format





MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Code 21PMTC41 L P C Category Core 6 - 4 Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: 6 - 4 Ocourse of the concepts of measures. 5 70 explain measurable sets and functions. 18 To introduce the concepts of measures. 18 18 18 Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. 18 18 Measurable Functions – Borel and Lebesgue Measurability. 18 18 18 Integration of Non-Negative Functions – The General Integral – Integration of Series. 18 18 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiatiole Functions. 18 18 Punctions of Bounded Variations – Lebesgue Differentiation Theorem – Differentiation and Integration – The Lebesgue Set 19 90 Books for Study: 18 18 18 Integration – The Chapter 2 Sections 2.1 to2.3 19 90 Books for Study: 90 18 18 Deamar, G, Measure Theory and Integration	Course Name	MEASURE THEORY AND IN	MEASURE THEORY AND INTEGRATION								
Category Core 6 - 4 Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: • To introduce the concepts of measures. • To explain measurable sets and functions. • To earn Riemann and Lebesgue integration. • To analyse the four derivatives and functions • 18 Unit: I Its Its Its Its Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Its Its Unit: II Its Its Its Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Its Its Unit: II Its Its Its Its Measurable Functions – Borel and Lebesgue Measurability. Its Its Its Integration of Non-Negative Functions – The General Integrat – Integration of Series. Its Its Unit: IV Its Its Its Its Functions. Its Its Its Its Outift V Its Its Its Its Books for Study: Books for Study:<	Course Code	21PMTC41			L	Р	С				
Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: • To introduce the concepts of measures. • To explain measurable sets and functions. • To explain measurable sets and functions. • To explain measurable sets and functions. • To explain measurable sets and functions • To explain measurable sets and functions • To use Lebesgue theorem in differentiation and integration. • Its 18 Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. • Its 18 Measure of Non-Negative Functions – The General Integration of Series. • Its 18 Integration of Non-Negative Functions – The General Integration of Series. • Its 18 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions. • Its 18 Unit: IV 18 18 18 18 Functions. 18 19 18 10 18 18 1	Category	Core			6	-	4				
COURSE OBJECTIVES: • To introduce the concepts of measures. • To explain measurable sets and functions. • To analyse the four derivatives and functions • To use Lebesgue theorem in differentiation and integration. Unit: I Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Unit: II Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV 18 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions. Unit: IV 18 Functions. 18 Functions of Bounded Variations – Lebesgue Differentiation Theorem – Differentiation and Integration – The Lebesgue Set 18 Gooks for Study: 90 Books for References: 10.10.2.3 Unit II – Chap	Nature of cours	se: EMPLOYABILITY	SKILL ORIENTED	ENTREP	REN	URSI	HIP				
 To introduce the concepts of measures. To explain measurable sets and functions. To learn Riemann and Lebesgue integration. To analyse the four derivatives and functions To use Lebesgue theorem in differentiation and integration. Unit: I Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Unit: II Measurable Functions – Borel and Lebesgue Measurability. Unit: III Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV Integration of Non-Negative Functions – The Four Derivatives – Continuous Non – Differentiable Functions, Unit: V Is Riemann and Lebesgue Set Total Lecture Hours 90 Books for Study: De Barra. G, Measure Theory and Integration, New Age International Pvt Ltd, Chennai, Reprint, 2010. Unit II – Chapter 2 Sections 2.1 to 2.3 Unit III – Chapter 3 Sections 3.1 to 3.3 Unit V – Chapter 4 Sections 4.4 & Chapter 4 Sections 4.4 & Chapter 4 Sections 4.1 & 4.2 Unit V – Chapter 4 Sections 4.1 & 4.2 Unit V – Chapter 4 Sections 4.1 & 4.2 Unit V – Chapter 4 Sections 4.1 & 4.2 Unit V – Chapter 4 Sections 4.1 & 4.6 Books for References: I. Royden, H.L., Real Analysis, Pretice-Hall of Indian Pvt. Ltd, 2008, NewDelhi. Jain, P.K and Gupta, P.K. Lebesgue Measure and Integration", I.K International Publishing House Pvt , Ltd, Reprint 2010, Chemai. Malik A. K & S.K.Gupta, "Measure Theory and Intregration", I.K International Publishing House Pvt , Ltd, Reprint 2017, New Delhi. 	COURSE OBJ	ECTIVES:									
 To explain measurable sets and functions. To learn Riemann and Lebesgue integration. To analyse the four derivatives and functions To use Lebesgue theorem in differentiation and integration. Unit: I I8 Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Unit: II I8 Measurable Functions – Borel and Lebesgue Measurability. Unit: IV I8 Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV I8 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions. Unit: V I8 Functions. Unit: V I8 Functions of Bounded Variations – Lebesgue Differentiation Theorem – Differentiation and Integration – The Lebesgue Set Total Lecture Hours 90 Books for Study: Be Barra. G, Measure Theory and Integration, New Age International Pvt Ltd, Chennai, Reprint, 2010. Unit I – Chapter 2 Sections 2.1 to 2.3 Unit II – Chapter 3 Sections 3.1 to 3.3 Unit IV – Chapter 3 Sections 3.1 to 3.3 Unit IV – Chapter 4 Sections 4.1 & 4.2 Unit V – Chapter 4 Sections 4.3 to 4.6 Books for References: 1. Royden, H.L., Real Analysis, Pretice-Hall of Indian Pvt. Ltd, 2008, NewDelhi. 2. Jain, P.K and Gupta, P.K, Lebesgue Measure and Integration, New Age International Pvt Ltd, Reprint 2010, Chennai. 3. Malik. A. K & S.K. Gupta, "Measure Theory and Intregration", I.K. International Publishing House Pvt , Ltd, Reprint 2017, New Delhi. Web Resources 1. http://math.ucsd.edu/-driver/240-00-01/Lecture Notes/measurep.pdf 	To intro	luce the concepts of measures.									
 To learn Riemann and Lebesgue integration. To analyse the four derivatives and functions To use Lebesgue theorem in differentiation and integration. Unit: I I8 Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Unit: II I8 Measurable Functions – Borel and Lebesgue Measurability. Unit: II I8 Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV I8 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions. Unit: V I8 Functions. Unit: V I8 Functions. Unit: Constructions – Lebesgue Differentiation Theorem – Differentiation and Integration – The Lebesgue Set Total Lecture Hours 90 Books for Study: De Barra. G, Measure Theory and Integration, New Age International Pvt Ltd, Chennai, Reprint, 2010. Unit I – Chapter 2 Sections 2.1 to 2.3 Unit III – Chapter 3 Sections 3.1 to 3.3 Unit IV – Chapter 3 Sections 3.1 to 3.3 Unit V – Chapter 4 Sections 4.3 to 4.6 Books for References: 1. Royden, H.L., Real Analysis, Pretice-Hall of Indian Pvt. Ltd, 2008, NewDelhi. 2. Jain, P.K and Gupta, P.K, Lebesgue Measurer and Integration, New Age International Pvt Ltd, Reprint 2010, Chennai. 3. Malik. A. K & S.K. Gupta, "Measure Theory and Intregration", I.K International Publishing House Pvt , Ltd, Reprint 2017, New Delhi. 	• To expla	in measurable sets and functions									
 To analyse the four derivatives and functions To use Lebesgue theorem in differentiation and integration. Unit: I I Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Unit: II I18 Measurable Functions – Borel and Lebesgue Measurability. Unit: III I18 Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV I18 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions. Unit: V I18 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions of Bounded Variations – Lebesgue Differentiation Theorem – Differentiation and Integration – The Lebesgue Set Total Lecture Hours 90 Books for Study: De Barra. G, Measure Theory and Integration, New Age International Pvt Ltd, Chennai, Reprint, 2010. Unit I – Chapter 2 Sections 2.1 to 2.3 Unit II – Chapter 3 Sections 3.1 to 3.3 Unit IV – Chapter 3 Sections 3.4 & Chapter 4 Sections 4.3 to 4.6 Books for References: Royden, H.L., Real Analysis, Pretice-Hall of Indian Pvt. Ltd, 2008, NewDelhi. Jain, P.K and Gupta. P.K, Lebesgue Measure and Integration, New Age International Publishing House Pvt , Ltd, Reprint 2010, Chennai. Malik. A. K & S.K.Gupta, "Measure Theory and Intregration", I.K International Publishing House Pvt , Ltd, Reprint 2017, New Delhi. 	• To learn Riemann and Lebesgue integration.										
 To use Lebesgue theorem in differentiation and integration. Unit: I I8 Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity. Unit: II I8 Measurable Functions – Borel and Lebesgue Measurability. I18 Integration of Non-Negative Functions – The General Integral – Integration of Series. Unit: IV I8 Riemann and Lebesgue integrals – The Four Derivatives – Continuous Non – Differentiable Functions. Unit: V I18 Functions of Bounded Variations – Lebesgue Differentiation Theorem – Differentiation and Integration – The Lebesgue Set Total Lecture Hours 90 Books for Study: De Barra. G, Measure Theory and Integration, New Age International Pvt Ltd, Chennai, Reprint, 2010. Unit I – Chapter 2 Sections 2.1 to2.3 Unit II – Chapter 3 Sections 3.1 to3.3 Unit IV – Chapter 3 Sections 4.4 & Chapter4 Sections 4.3 to 4.6 Books for References: I. Royden, H.L., Real Analysis, Pretice-Hall of Indian Pvt. Ltd, 2008, NewDelhi. Jain, P.K and Gupta. P.K, Lebesgue Measure and Integration, New Age International Publishing House Pvt , Ltd, Reprint 2010, Chennai. Malik. A. K & S.K.Gupta, "Measure Theory and Integration", I.K International Publishing House Pvt , Ltd, Reprint 2017, New Delhi. Web Resources http://math.ucsd.edu/~driver/240-00-01/Lecture Notes/measurep.pdf 	• To analy	se the four derivatives and functi	ons								
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COUR	RSE OUTCOMES	K Level				
On the	On the successful completion of the course , the students will be able to					
CO1:	Explain the concepts of Lebesgue integral.	K4				
CO2:	Analyze the geometrical meaning of measurable functions and integrations.	K4				
CO3:	Apply the techniques of measure theory to evaluate integrals	K3				
CO4:	Compare Riemann with other integrals.	K4				
CO5 :	Identify four derivatives and Lebesgue differentiation theorem.	K3				

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	3	3	2	-
CO 2	3	1	2	2	2	1
CO 3	3	1	3	3	2	1
CO 4	3	1	3	3	2	-
CO 5	3	1	3	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Measure on the Real line – Lebesgue Outer Measure – Measurable sets-Regularity.	18	Chalk & Talk, PPT
II	Measurable functions – Borel and Lebesgue Measurability.	18	Chalk & Talk
III	Integration of non-negative functions – The general integral – Integration of series.	18	Chalk & Talk, PPT
IV	Riemann and Lebesgue integrals – The four derivatives – Continuous non – differentiable functions.	18	Chalk & Talk
V	Functions of bounded variations – Lebesgue differentiation theorem – Differentiation and Integration – The Lebesgue set	18	Chalk & Talk

Course Designed by:

Dr. R. Bhavani Assistant Professor & Dr. S. Andal, Assistant Professor

Learning Outcome Based Education & Assessment (LOBE)										
Formative Examination - Blue Print										
Articulation Mapping – K Levels with Course Outcomes (COs)										
			Sectio	on A	Sectior	n B	Section	Section		
			MC	Qs	Short Ans	swers	С	D		
Internal	Cos	K Level	No of	К.	No of	К.	Either	Open		
			Questions	Level	Ouestions		or	Choice		
			Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K4	2	K1&K2	1	K1	2	1		
AI	CO2	Upto K4	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K3	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1		
	No. of									
	Que	estions to	4		3		4	2		
	b	e asked								
Question]	No. of								
Dottorn	Que	estions to	4		3		2	1		
	be a	answered								
	Marl	ks for each	1		2		5	10		
11	q	uestion	L		2		5	10		
	Tot	al Marks								
	fe	or each	4		6		10	10		
	S	section								

		Dist	tribution of 1	Marks wit	h K Level	CIA I &	CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
	Outcomes (COs)							
		IZ.	MC	MCQs		Short Answers		Section D
S.No	COs	K- Laval	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)
2	CO2	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)
3	CO3	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
5	CO5	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
No. o	of Quest	ions to be	10		5		10	5
	Aske	d	10		2		10	0
No. o	of Quest	ions to be	10		5		5	3
	answe	red	10		5		5	5
Marks for each question		1		2		5	10	
Total Marks for each		10		10		25	30	
section		10		10		25	30	
	(Figures in parenthesis denotes, questions should be asked with the given K level)							

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	22		
K2	5	6	20		31	25.8			
K3			30	20	50	41.7	42		
K4				30	30	25	25		
Marks	10	10	50	50	120	100	100		
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.								

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shoi	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K3	
16) b	CO1	K3	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K2	
18) b	CO3	K2	
19) a	CO4	K3	
19) b	CO4	K3	
20) a	CO5	K2	
20) b	CO5	K2	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels		=	
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questic	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K4	
22	CO2	K4	
23	CO3	K3	
24	CO4	K4	
25	CO5	K3	
23 24 25	CO3 CO4 CO5	K3 K4 K3	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Code 21PMTC42 L P C Category Core 6 - 4 Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: • To develop the skills in analyzing the basic structure of Normed spaces. • • To use some special classes of functions. • •
Category Core 6 - 4 Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: - - - - - - 4 • To develop the skills in analyzing the basic structure of Normed spaces. - - - - 4
Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: • To develop the skills in analyzing the basic structure of Normed spaces. • • To use some special classes of functions. • • •
 COURSE OBJECTIVES: To develop the skills in analyzing the basic structure of Normed spaces. To use some special classes of functions.
To develop the skills in analyzing the basic structure of Normed spaces.To use some special classes of functions.
• To use some special classes of functions.
1
• To explain various types of operators.
• To understand Banach and Hilbert spaces
 To learn various standard theorems on functional analysis
Unit. I
Unit. I 10
normed spaces, Bahach Spaces – Further properties of hormed spaces – finite unitensional
Unit: II 18
Bounded and Continuous Linear Operators-Linear Functionals – Linear Operators and
Functional on Finite Dimensional Spaces – Normed Spaces of Operators and Dual Spaces - Inner
Product Space. Hilbert Space - Further Properties of Inner Product Spaces
Unit: III
Orthogonal Complements and Direct Sums – Orthonormal Sets and Sequences – Series Related to
Orthonormal Sets and Sequences – Total Orthonormal Sets and Sequences- Representation of
Functional on Hilbert Spaces
Unit: IV
Hilbert Adjoint Operator - Self Adjoint Operators, Unitary and Normal Operators - Zorn's
emma - Hahn-Banach Theorem- Hahn-Banach Theorem for Complex Vector Spaces and
Normed Spaces - Bounded Linear Functional on C[A, B] and Its Applications.
Unit: V 18
Adjoint Operator - Reflexive Spaces – Uniform Boundedness Theorem - Strong and Weak
Convergence – Convergence of Sequences of Operators and Functional – Open Mapping
Theorem - Closed Granh Theorem
Total Lecture Hours 90
Rooks for Study.
Introductory Functional Analysis with Annlications by Frwin Kreyszig John Wiley $\&$
Sons Publication (2006)
Unit I- Chapter 2: Sections 2 2-2 6
Unit II - Chapter 2: Section 2.7 -2.10
Chapter 3: Sections $31 - 32$
Unit III - Chapter 3: Sections $3.3 - 3.6 & 3.8$
Unit IV- Chapter 3: Section 3.9 -3.10
Chapter 4: Sections 4.1 -4.4
Unit V - Chapter 4: Sections $4.5 - 4.9 & 4.12 - 4.13$
$-\pi \tau = -\pi \mu \mu \tau \tau = -\pi \tau = -$
Books for References:

1.	limaye. B. V, Functional Analysis, New age International PV1. Ltd, 2007, NewDeir	11.
2.	PawanK.Jain & OM.P.Ahuja, Functional Analysis, New Age International (P) Limited,
]	NewDelhi.	
3. '	Thamban Nair, M. "Functional Analysis- A First course, PHI Learning Private	Limited.
	2002. NewDelhi.	,
Weł	Resources	
]	https://people.math.ethz.ch/~salamon/PREPRINTS/funcana.pdf	
	. https://nptel.ac.in/courses/111/106/111106147/https://www.youtube.com/watc	h?v=Qzc
	azcGZUFQ&list=PLmx4utxjUQD4xJkiHY4pp720LyeCZyEKW	
	https://ocw.mit.edu/courses/mathematics/18-102-introduction-to-functional-a	nalysis-
	spring 2000/losture potos/	
	spring-2009/lecture-notes/	
CO	JRSE OUTCOMES	K Level
CO On	JRSE OUTCOMES he successful completion of the course , the students will be able to	K Level
CO On	JRSE OUTCOMES he successful completion of the course , the students will be able to Explain the concepts of Normed Spaces, Banach Spaces, Compactness and	K Level
CO On CO	JRSE OUTCOMES he successful completion of the course , the students will be able to Explain the concepts of Normed Spaces, Banach Spaces, Compactness and Dimensions	K Level
CO On CO CO	JRSE OUTCOMES he successful completion of the course , the students will be able to L: Explain the concepts of Normed Spaces, Banach Spaces, Compactness and Dimensions L: List the operators and its properties.	K Level K4 K4
CO On CO CO	JRSE OUTCOMES he successful completion of the course , the students will be able to L: Explain the concepts of Normed Spaces, Banach Spaces, Compactness and Dimensions L: List the operators and its properties. L: Analyze the Orthogonal complements, ortho-normal sets and sequences	K Level K4 K4 K4
CO On CO CO CO	JRSE OUTCOMES he successful completion of the course , the students will be able to L: Explain the concepts of Normed Spaces, Banach Spaces, Compactness and Dimensions L: List the operators and its properties. L: Analyze the Orthogonal complements, ortho-normal sets and sequences L: Make use of the bounded linear functional, various operators and Hahn-	K Level K4 K4 K4 K4
COI On CO CO CO	Spring-2009/recurre-notes/ JRSE OUTCOMES he successful completion of the course , the students will be able to L: Explain the concepts of Normed Spaces, Banach Spaces, Compactness and Dimensions L: List the operators and its properties. L: Analyze the Orthogonal complements, ortho-normal sets and sequences I: Make use of the bounded linear functional, various operators and Hahn-Banach Theorem	K Level K4 K4 K4 K3
COI On t CO CO CO	JRSE OUTCOMES he successful completion of the course , the students will be able to 1: Explain the concepts of Normed Spaces, Banach Spaces, Compactness and Dimensions 2: List the operators and its properties. 3: Analyze the Orthogonal complements, ortho-normal sets and sequences 1: Make use of the bounded linear functional, various operators and Hahn-Banach Theorem : Analyze Uniform boundedness, open mapping, closed graph theorem, Strong	K Level K4 K4 K4 K3 K4

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	2	3	2	2
CO 2	3	2	2	3	2	2
CO 3	2	2	2	2	1	1
CO 4	2	2	2	3	1	1
CO 5	3	2	2	3	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Normed Spaces, Banach Spaces – Further properties of no med spaces – finite dimensional normed spaces and Subspaces - Compactness and Finite Dimension - Linear operators	18	Chalk & Talk
Π	Bounded and Continuous linear operators-Linear functionals – linear operators and functional on finite dimensional spaces –normed spaces of operators and dual spaces - Inner product space, Hilbert space - Further properties of inner product spaces	18	Chalk & Talk, PPT
III	Orthogonal complements and direct sums – Orthonormal sets and sequences –series related to orthonormal sets and sequences – Total orthonormal sets and sequences- representation of functionals on Hilbert spaces.	18	Chalk & Talk
IV	Hilbert Adjoint operator - Self adjoint operators, unitary and normal operators - Zorn's Lemma - Hahn-Banach Theorem- Hahn-Banach theorem for complex vector spaces and normed spaces - Bounded Linear Functional on C[a, b] and its Applications.	18	Chalk & Talk, PPT
V	Adjoint operator - Reflexive spaces – Uniform boundedness theorem - Strong and weak convergence – Convergence of sequences of operators and functional – Open mapping theorem - Closed graph theorem.	18	Chalk & Talk

Course Designed by:

Dr. V. Ramachandran, Assistant Professor & Dr. A. Hamari Choudhi, Head & Associate Professor

Learning Outcome Based Education & Assessment (LOBE)

	Formative Examination - Blue Print								
	Articulation Mapping – K Levels with Course Outcomes (COs)								
			Section A		Section B		Section C	Section D	
Inte	Car	V I anal	MC	Qs	Short Ans	swers	Section C	Section D	
rnal	Cos	K Level	No. of.	K -	No. of.	K -	Either or	Open	
			Questions	Level	Questions	Level	Choice	Choice	
CI	CO1	Upto K4	2	K1&K2	1	K1	2	1	
AI	CO2	Upto K4	2	K1&K2	2	K2	2	1	
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1	
AII	CO4	Upto K3	2	K1&K2	2	K2	2	1	
	•	No. of							
		Questions to	4		3	4	4	2	
		be asked							
		No. of			3		2	1	
Que	stion	Questions to	4						
Pat	tern	be answered							
CIA	CIA I & II Marks for		1		2		5	10	
		each question	1		2		5	10	
		Total Marks							
		for each	4		6		10	10	
		section							

	Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
	Outcomes (COs)							
		TZ	MC	Qs	Short An	swers	Section C	Section D
S.No	COs	K -	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)
2	CO2	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)
No. (of Quest	ions to be	10		5		10	5
	Aske	ed	10		5		10	2
No. o	of Quest	ions to be	10		5		5	3
answered		red	10		3		5	3
Marks for each question		1		2		5	10	
Total Marks for each		10		10		25	20	
	section		10		10		25	
	(Figures in parenthesis denotes, questions should be asked with the given K level)							

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	24		
K2	5	6	20		31	25.9	54		
K3			30	10	40	33.3	33		
K4				40	40	33.3	33		
Marks	10	10	50	50	120	100	100		
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.									

Section	A (Mu	ltiple Cho	ice Questions)
Answei	r All Q	uestions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Sho	ort Answei	rs)
Answei	r All Q	uestions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eit	her/Or Ty	pe)
Answei	r All Q	uestions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	COI	K3	
16) b	COI	K3	
1/)a	CO2	K3	
1/)b	CO2	K3	
18) a	CO3	K3 K2	
18) b	CO3	K3 K2	
19) a	CO4	K2 K2	
19) b	CO4	K2 K2	
20) a	C05	K2 K2	
20) D	<u> </u>	<u> </u>	
NB: HI	gher le	vel of peri	ormance of the students is to be assessed by attempting higher
Section	\mathbf{R} leve	an Chaice	
Answei	r Anv T	Three ques) tions (3x10-30 marks)
		K Loval	Ouestions
21	CO1	K4	<u>Yutsuons</u>
22	CO^{1}	K4	
23	CO3	K4	
23	CO4	K3	
25	CO5	K4	
25	005	117	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	PR	ROJECT						
Course Code	21P	PMTPR1 L P C						
Category	Pro	Project 6						
Nature of cours	se:	: EMPLOYABILITY SKILL ORIENTED ENTREPRI						

Course Description

The Project is conducted by the following Course Pattern.

Internal

Presentation Submission } 40 External Project Report Viva Voce } 60 Total - 100

COURSE OUTCOMES						
On the successful completion of the course , the students will be able to						
CO1:	Apply the skill of presentation and communication techniques	K3				
CO2:	Motive as an individual or in a team in development of projects.	K4				
CO3:	Analyze the available resources and to select most appropriate one	K4				
CO4:	Make use of the fundamentals of Mathematics to search the related literature survey	K3				
CO5:	Evaluate the real life problems by using Mathematics and its Application.	K5				

Course Designed by:

Dr. R. Bhavani Assistant Professor & Dr. A. Hamari Choudhi, Head & Associate Professor

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	3	3	3	1	3
CO 2	1	2	2	1	2	1
CO 3	2	2	3	3	2	1
CO 4	3	2	3	2	1	2
CO 5	3	3	3	3	3	3

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	NUMBER THEORY					
Course Code	21PMTE41			L	Р	С
Category	Elective			6	-	6
Nature of cours	e: EMPLOYABILITY	SKILL ORIENTED	ENTREPF	RENU	JRSH	IP
COURSE OBJ	ECTIVES:					
To know	the basic concepts in number the	ory.				
• To learn	number theoretical functions.	-				
 To study 	Euclid's and division algorithm.					
• To famil	iarize about primitive roots.					
• To under	stand the fundamental theorem in	number theory.				
Unit: I					1	8
Well ordering p	inciple, induction, binomial coef	ficients. Greatest intege	r function	_		-
Divisibility: Not	ion of divisibility, G. C. D., Eucl	id's Algorithm, L.C.M,	Representa	tions	of	
integers	3 7 7	6,,,,,	1			
Unit: II					1	8
Primes: Definiti	on, Prime counting function, Prin	ne number theorem ,Te	est of Prima	lity, S	lieve	
of Eratosthenes,	Canonical factorization, Fundame	ental theorem of Arithm	netic.	5 /		
Unit: III					1	8
Congruences :	Congruences and Equivalence	e relations, Linear	Congruence	e, L	inear	
Diophantine equ	ations, Chinese Remainder The	eorem, Polynomial C	ongruences	, Moo	dular	
Arithmetic, Ferr	nat's Theorem, Wilson's Theorem	n, Pythagorean equation	l.			
Unit: IV					1	8
Arithmetic function	ions: Sigma, Tau functions, Diric	hlet product, Dirichlet i	inverse, Mo	bius f	uncti	on,
Luier S function	, Euler's theorem				1	0
Drimitivo rooto:	Definition properties Existence	Quadratia Congruances	Quadratia	Dari		0
I agandra symbolis.	ls Gauss lamma Law of quadrat	quadratic Congruences		Kesh	iues,	
	is, Gauss Iellina, Law 61 quadrat	Tot	al Lactura	Нош	n G	0
Books for Stud	£7●	10		Hou	5 /	0
Neville Robbing	Beginning of Number Theory	v Second Edition Nat	osa nublica	tions		
New Delhi 200		y, becond Edition, run	osa puonea	uions	,	
Unit I-	Chapters 12					
Unit II - Chapter · 3						
Unit III - Chapter · 4						
Unit IV - Chapter :5						
Unit V - Chapter 6: sections 1.2& 3 only.						
Chapter 7: sections 1,2 and 3 only.						
Books for Refe	rences:	-				
1. Ivan Niv	en, Introduction to Theory of n	umbers, Wiley Eastern	,2009.			
2. Tom M.	Apostal, Introduction to Analyt	ic Number Theory, Sp	oringer			
Internati	onalEdition,	v · 1	-			

	3. Martin Erichson & Anthony Vazzana, " Introduction to Number	
	Theory", Saurabh printers Private Ltd, 2010.	
Web	Resources	
1	http://www2.math.uu.se/~lal/kompendier/Talteori.pdf	
2	https://nptel.ac.in/courses/111/101/111101137/	
3	https://nptel.ac.in/courses/111/103/111103020/	
COU	RSE OUTCOMES	K Level
On t	ne successful completion of the course , the students will be able to	
CO1	Explain the numbering concepts.	K4
CO2	Apply the concepts of prime numbers and principles to solve problems	K3
CO3	Solve the system of linear congruencies with different module using the	V2
COS	Chinese Reminder Theorem.	KJ
CO4	Categorize the various arithmetic functions	K4
CO5	Examine the quadratic residues and quadratic non-residues using congruences.	K4

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 –Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
I	Well ordering principle, induction, binomial coefficients, Greatest integer function – Divisibility :Notion of divisibility, G. C. D, Euclids Algorithm, L.C.M, Representations of integers	18	Chalk & Talk
Π	Primes: Definition, Prime counting function, Prime number theorem, Test of Primality, Sieve of Eratosthenes, Canonical factorization, Fundamental theorem of Arithmetic.	18	Chalk & Talk
III	Congruences : Congruences and Equivalence relations, Linear Congruence, Linear Diophantine equations, Chinese Remainder Theorem, Polynomial Congruences, Modular Arithmetic, Fermat's Theorem, Wilson's Theorem, Pythagoreanequation.	18	Chalk & Talk
IV	Arithmetic functions: Sigma, Tau functions, Dirichlet product, Dirichlet inverse, Mobius function, Euler's function, Euler's theorem	18	Chalk & Talk
V	Primitive roots: Definition, properties, Existence-Quadratic Congruences : Quadratic Residues, Legendre symbols, Gauss lemma, Law of quadratic reciprocity.	18	Chalk & Talk

Course Designed by:

Dr. R. Bhavani Assistant Professor & Dr. S. Andal, Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)							
	Formative Examination - Blue Print							
	-	Articulation	Mapping – I	K Levels w	ith Course C	Jutcome	s (COs)	
			Sectio	n A	Sectior	n B	Section C	Section D
Inte	Cos	K I ovol	MCO	Qs	Short Answers		Section C	Open
rnal	rnal Cos	K Level	No. of.	К-	No. of. K -	Choico	Choico	
		Questions	Level	Questions	Level	Choice	Choice	
CI	CO1	Upto K4	2	K1&K2	1	K1	2	1
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1
CI	CO3	Upto K3	2	K1&K2	1	K2	2	1
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1
		No. of						
		Questions to	4		3		4	2
		be asked						
		No. of						
Que	stion	Questions to	4		3		2	1
Pat	tern	be answered						
CIA	I & II	Marks for	1		2		5	10
		each question	1		2		5	10
		Total Marks						
		for each	4		6		10	10
		section						

		D	istribution of	Marks wit	h K Level (CIAI& C	CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
	1	1	ſ	Outcomes	(COs)		ſ	
		V	MC	Qs	Short Answers		Section C	Section D
S.No	COs	K- Loval	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)
No. o	of Quest	ions to be	10		5		10	5
	Aske	d	-		_		-	-
No. o	of Quest	ions to be	10		5		5	3
answered		10		2		2	0	
Marks for each question		1		2		5	10	
Total Marks for each		10		10		25	20	
section			10		10		25	
	(Figure	s in parenth	esis denotes,	questions	should be a	sked witl	n the given K	level)

	Distribution of Marks with K Level							
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %	
K1	5	4			9	7.5	42	
K2	5	6	30		41	34.2	42	
K3			20	20	40	33.3	33	
K4				30	30	25	25	
Marks	10	10	50	50	120	100	100	
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.							

Section A (Multiple Choice Questions)					
Answei	r All Q	uestions	(10x1=10 marks)		
Q.No	CO	K Level	Questions		
1	CO1	K1			
2	CO1	K2			
3	CO2	K1			
4	CO2	K2			
5	CO3	K1			
6	CO3	K2			
7	CO4	K1			
8	CO4	K2			
9	CO5	K1			
10	CO5	K2			
Section	B (Sho	ort Answer	rs)		
Answei	r All Q	uestions	(5x2=10 marks)		
Q.No	CO	K Level	Questions		
11	CO1	K1			
12	CO2	K1			
13	CO3	K2			
14	CO4	K2			
15	CO5	K2			
Section	C (Eit	her/Or Ty	pe)		
Answei	r All Q	uestions	(5 x 5 = 25 marks)		
Q.No	CO	K Level	Questions		
16) a	CO1	K3			
16) b	COI	K3			
17) a	CO2	K2			
17) b	CO2	K2			
18) a	CO3	K2			
18) b	CO3	K2			
19) a	CO4	K3			
19) b	CO4	K3			
20) a	C05	K2 K2			
20) b	<u>CO5</u>	<u>K2</u>			
NB: HI	gner le	vel of perio	ormance of the students is to be assessed by attempting higher		
level of	N leve	is or Chaine			
Section A neuro	D (Op	en Choice	(3x10-30 montrs)		
Allswei O No		K L ovol	Overtions (5x10=50 Illarks)		
21	CO1	K Level	Questions		
21	CO1	K2			
22	CO_2	K3			
23	CO_4	KA KA			
24	C04	<u></u> κ4 ν/			
23	CUS	N 4			

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Code21PMTE42LPCCategoryElective6-6Nature of course:EMPLOYABILITYSKILL ORIENTEDENTREPRENURSHIPCOURSE OBJECTIVES:ENTREPRENURSHIPCOURSE OBJECTIVES: \cdot • To understand the rules of sum and product \cdot \cdot \cdot • To study the Generating functions, Partitions of integers. \cdot \cdot \cdot • To identify the recurrence relations with constant coefficients, and Recurrence relations with two indices. \cdot \cdot • To familiarize the concept of principle of inclusion and exclusion. \cdot \cdot \cdot • To understand Tundamental theorem. \cdot \cdot \cdot \cdot Unit: I \cdot \cdot \cdot \cdot \cdot Of the rules of Sum and Product - Permutations - Distributions of Distinct Objects \cdot \cdot \cdot Unit: II \cdot \cdot \cdot \cdot \cdot Generating Functions for Combinations - Enumerators for Permutations - Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers - Elementary relations \cdot \cdot Unit: III \cdot \cdot \cdot \cdot \cdot Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices. \cdot \cdot
Category Elective 6 - 6 Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: 5 5 5 • To understand the rules of sum and product 6 - 6 • To understand the rules of sum and product 5 5 5 • To study the Generating functions, Partitions of integers. 5 5 5 • To identify the recurrence relations with constant coefficients, and Recurrence relations with two indices. 18 • To understand fundamental theorem. 18 • The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects 18 • Image: Sum and Product - Permutations - Combinations - Distributions of Distributions of Distinct Objects - Distributions of Non distinct Objects 18 • Image: Sum and Product Cells - Partitors of Integers - Elementary relations 18 • Image: Sum and Product - Permutations - Enumerators for Permutations - Distributions of Distributions of Distributions of Integers - Elementary relations 18 • Image: Sum and Product - Cells - Partitors of Integers - Elementary relations 18
Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP COURSE OBJECTIVES: - </td
COURSE OBJECTIVES: • To understand the rules of sum and product • To study the Generating functions, Partitions of integers. • To identify the recurrence relations with constant coefficients, and Recurrence relations with two indices. • To familiarize the concept of principle of inclusion and exclusion. • To understand fundamental theorem. Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations - Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers - Elementary relations Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
 To understand the rules of sum and product To study the Generating functions, Partitions of integers. To identify the recurrence relations with constant coefficients, and Recurrence relations with two indices. To familiarize the concept of principle of inclusion and exclusion. To understand fundamental theorem. Unit: I Intervention of Non distinct Objects Unit: II Intervention of Non distinct Objects Interventions of Non distinct Objects Interventions of Non distinct Cells - Partitions of Integers – Elementary relations Interventions of Integers – Elementary relations Interventions with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
 To study the Generating functions, Partitions of integers. To identify the recurrence relations with constant coefficients, and Recurrence relations with two indices. To familiarize the concept of principle of inclusion and exclusion. To understand fundamental theorem. Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Cells - Partitions of Integers – Elementary relations Unit: II 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
 To identify the recurrence relations with constant coefficients, and Recurrence relations with two indices. To familiarize the concept of principle of inclusion and exclusion. To understand fundamental theorem. Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
two indices. • To familiarize the concept of principle of inclusion and exclusion. • To understand fundamental theorem. Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
 To familiarize the concept of principle of inclusion and exclusion. To understand fundamental theorem. Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects Unit: II Generating Functions for Combinations - Enumerators for Permutations - Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers - Elementary relations Unit: II I18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
 To understand fundamental theorem. Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects Unit: II Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations Unit: III I18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
Unit: I 18 The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects 18 Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations 18 Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices. 18
The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects 18 Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations 18 Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices. 18
Distributions of Non distinct Objects 18 Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of 0 Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations 18 Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of 18 Generating Functions - Recurrence Relations with Two Indices. 18
Unit: II 18 Generating Functions for Combinations - Enumerators for Permutations – Distributions of of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations 18 Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of 6 Generating Functions - Recurrence Relations with Two Indices. 18
Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations Unit: III Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
Unit: III 18 Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices.
Generating Functions - Recurrence Relations with Two Indices.
Unit: IVThe Principle of Inclusion and Exclusion - The General Formula - Derangements - Permutations with Restrictions on Relative Positions - The Rook Polynomials.18
Unit: V 18
Equivalence Classes under a Permutation Group - Equivalence Classes of Functions -Weights
and Inventories of Functions - Polya's Fundamental Theorem - Generalization of Polya's
Theorem.
Total Lecture Hours 90
Books for Study:
C. L. Liu, Introduction to Combinatorial Mathematics, McGraw-Hill Inc., Newyork, 1968.
Unit I - Chapter 1: Sections 1.1 to 1.6
Unit II - Chapter 2: Sections 2.1 to 2.5 and 2.7
Unit III: - Chapter 3: Sections 3.1 to 3.5 (Except 3.4)
Unit IV: - Chapter 4: Sections 4.1 to 4.6
Unit V: - Chapter 5: Sections 5.1 to 5.7 (Except 5.2)
Books for References:
1. J. H. Van Lint and R. M. Wilson, A Course in Combinatorics, Cambridge University Press, 2001.
2. TituAndreescu and ZumingFeng, A Path to Combinatorics, Springer Science & Business Media, 2004.
3. Douglas West, Combinatorial Mathematics, Cambridge University Press, 2020.
Web Resources
1. <u>https://www.isinj.com/mt-</u>

us	usamo/Applied%20Combinatorics%20(6th%20Edition)%20by%20Alan%20Tucker%20							
W	Wiley%20(2012).pdf							
2. <u>ht</u>	2. <u>http://cseweb.ucsd.edu/~gill/AlgCombSite/Resources/CCSRefP1.pdf</u>							
3. <u>https://en.wikipedia.org/w/index.php?title=Special:WhatLinksHere⌖=Algorithm</u>								
COUI	COURSE OUTCOMES K Level							
On th	On the successful completion of the course , the students will be able to							
CO1:	Understand the rules of Sum and Product of Permutations and Combinations.	K2						
CO2	Discuss distributions of Distinct Objects into Non-distinct Cells and Partitions of	K3						
002.	Integers.	IX.J						
CO3.	Identify Solutions by the technique of Generating Functions and Recurrence Relations	K3						
005.	with Two Indices.	IX3						
CO4·	Make use of the concepts of Permutations with Restrictions on Relative Positions and	K3						
0.04.	the Rook Polynomials.	IX3						
CO5:	Analyze equivanlence classes of functions in Polya's Theory	K4						

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 –Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Permutations and Combinations Introduction - The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects	18	Chalk & Talk
II	Generating Functions Introduction - Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers – Elementary relations	18	Chalk & Talk, PPT
III	Recurrence Relation Introduction - Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices	18	Chalk & Talk
IV	The Principle of Inclusion and Exclusion Introduction - The Principle of Inclusion and Exclusion - The General Formula - Derangements - Permutations with Restrictions on Relative Positions - The Rook Polynomials	18	Chalk & Talk, PPT
V	Theory of Counting Introduction - Equivalence Classes under a Permutation Group - Equivalence Classes of Functions - Weights and Inventories of Functions - Polya's Fundamental Theorem - Generalization of Polya's Theorem	18	Chalk & Talk

Course Designed by:

Dr. M. Saravanan Assistant Professor & Dr. A. Arivu Chelvam, Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)									
	Formative Examination - Blue Print									
	Articulation Mapping – K Levels with Course Outcomes (COs)									
			Sectio	on A	Section	B	Section C	Section D		
Inte	Cos	K I ovol	MC	Qs	Short Ans	swers	Fither or	Open		
rnal	CUS	K Level	No. of.	K –	No. of.	K -	Choice	Choice		
			Questions	Level	Questions	Level	Choice	Choice		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1		
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1		
CI	CO3	Upto K3	2	K1&K2	1	K2	2	1		
AII	CO4	Upto K3	2	K1&K2	2	K2	2	1		
· · ·		No. of								
		Questions to	4		3		4	2		
		be asked								
		No. of								
Que	stion	Questions to	4		3		2	1		
Pat	tern	be answered								
CIA I & II		Marks for	1		2		5	10		
		each question	l		2		3	10		
		Total Marks								
		for each	4		6		10	10		
		section								

	Distribution of Marks with K Level CIA I & CIA II									
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
	K4			10	10	20	40	40		
1	Marks	4	6	20	20	50	100	100		
	K1	2	2			4	8	20		
	K2	2	4			6	12	20		
CIA	K3			10	10	20	40	40		
II	K4			10	10	20	40	40		
	Marks	4	6	20	20	50	100	100		

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course									
Outcomes (COs)										
		K	MC	Qs	Short An	swers	Section C	Section D		
S.No	COs	I ovol	No. of	K –	No. of	K –	(Either /	(Open		
		Level	Questions	Level	Question	Level	or Choice)	Choice)		
1	CO1	Upto K2	2	K1&K2	1	K1	2(K2&K2)	1(K2)		
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)		
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)		
4	CO4	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)		
5	CO5	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
No.	of Questi	ons to be	10		5		10	5		
	Aske	d	10		5		10	2		
No.	of Questi	ons to be	10		5		5	2		
	answer	ed	10		5		5	3		
Marks for each question		1		2		5	10			
Total Marks for each		10		10		25	20			
	sectio	n	10		10		25	30		
	(Figures	in parenthe	sis denotes,	questions s	hould be as	ked with	n the given K	level)		

	Distribution of Marks with K Level										
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %				
K1	5	4			9	7.5	25				
K2	5	6		10	21	17.5	25				
K3			20	20	40	33.3	33				
K4			30	20	50	41.7	42				
Marks	10	10	50	50	120	100	100				
NB: Hig	gher level of p	erformance o	f the students	s is to be asse	essed by a	attempting	higher level				
i of K lev	els.										

Section	A (Mul	tiple Choice	e Questions)
Answer	All Qu	estions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (Shor	rt Answers)	
Answer	All Qu	estions	(5x2=10 marks)
Q.No	СО	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eith	er/Or Type	
Answer	All Qu	estions	(5 x 5 = 25 marks)
Q.No	СО	K Level	Questions
16) a	CO1	K2	
16) b	CO1	K2	
17) a	CO2	K3	
17) b	CO2	K3	
18) a	CO3	K3	
18) b	CO3	K3	
19) a	CO4	K3	
19) b	CO4	K3	
20) a	CO5	K3	
20) b	CO5	K3	
NB: Hig	gher lev	el of perfor	mance of the students is to be assessed by attempting higher level of K
levels			
Section	D (Ope	n Choice)	
Answer	Any Tl	hree questio	ons (3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K3	
24	CO4	K3	
25	CO5	K4	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	DIFFERENTIAL GEOM	ETRY									
Course Code	21PMTE43			L	Р	С					
Category	Elective	6	-	6							
Nature of course: EMPLOYABILITY SKILL ORIENTED ENTREPRENURSHIP											
COURSE OBJECTIVES:											
COURSE OBJECTIVES: • To study the classical theory of curves and surfaces. • To learn the fundamental existence theorem of space curve. • To know the local intrinsic and local non-intrinsic properties of surfaces. • To deal with the fundamental equations of surface theory. • To learn the applications of Differential Geometry. • Unit: I Representation of space curves – Unique parametric representation of a space curve – Arc length – Tangent and osculating plane – Principal normal and binormal – Curvature and Torsion – Behavior of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces – Contact between curves and surfaces – Osculating circle and osculating sphere – Locus of centres of spherical curvature – Tangent surfaces, involutes and evolutes – Bertrand Curves - Spherical indicatrix - Intrinsic equations of space curves - Fundamental existence theorem for space curves - Helices. Unit: II 18											
Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on											
surfaces – Tang	ent plane and surface normal	– The general surfaces of rev	volution – H	Helico	oids –	-					
Metricon a surfa	ce – The First Fundamental I	form – Direction coefficients	on a surfac	e - F	amili	les					
Intrinsic propert	ies	laminy of curves – isometric	correspond	ence							
Unit: III					1	8					
Geodesic and th of revolution – I property – Exist curvature – Gau	Unit: III 18 Geodesic and their differential equations – Canonical geodesic equations – Geodesics on surfaces of revolution – Normal property of geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic polar coordinates – Geodesic curvature – Gauss–Bonnet Theorem – Gaussian curvature – Surfaces of constant curvature.										
Unit: IV					1	8					
The second fundamental form – Classification of points on a surface – Principal curvatures – Linesof curvature – The Dupin indicatrix– Developable surfaces – Developables associated with spacecurves –Developables associated with curves on surfaces – Minimal surfaces – Ruled surfaces.Unit: V18											
I ensor notations	- Gauss equations – Weing	arten equations – Mainardi-C	odazzi equ	ations	s –						
Parallel surfaces.											
Total Lecture Hours 90 Books for Study: 90											
Somasundaram. Unit I- Unit I Unit I	D., Reprint 2019, Differentia Chapters :1(1.1 - 1.18) I - Chapter : 2(2.1 - 2.15) II - Chapter : 3(3.1 - 3.13)	al Geometry, Narosa Publish	ing House,	Chen	nai.						

Unit IV - Chapter : 4(4.1 – 4.11) Unit V - Chapter 5(5.1 – 5.6)

Books for References:

1. Mittal and Agarwal, 2014, Differential Geometry, Krishna Prakasan Media (P) Ltd., India.

2. Thierry Aubin, 2001, Differential Geometry, American Mathematical Society, Providence, US.

3. Willmore. T.J., 2018, An introduction to Differential Geometry, Oxford University Press,

New Delhi.

Web Resources

1.<u>https://books.google.gm/books?id=dbIAAQAAQBAJ&printsec=copyright&source=gbs_pu</u> <u>b_info_r</u>

2.<u>https://picfs.com/1aqi82</u>

3.<u>https://en.wikipedia.org/wiki/Differential_geometry#:~:text=Differential%20geometry%20i</u>s%20a%20mathematical,linear%20algebra%20and%20multilinear%20algebra.

COUR	SE OUTCOMES	K Level				
On the successful completion of the course, the students will be able to						
CO1:	Demonstrate the Understanding the concept of space curves.	K2				
CO2:	Identify metric on a surface, direction coefficients on a surface and nature of	K3				
	points on the surface.					
CO3:	Analyze Geodesic and their differential equations	K4				
CO4:	List topological aspects of surfaces.	K4				
CO5.	Analyse the Weingarton Equations, Gaussian equations, Mainardi-Codazzi	V A				
005:	equations	N4				

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 –Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Representation of space curves – Unique parametric representation of a space curve – Arc length – Tangent and osculating plane – Principal normal and binormal – Curvature and Torsion – Behavior of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces – Contact between curves and surfaces – Osculating circle and osculating sphere – Locus of centres of spherical curvature – Tangent surfaces, involutes and evolutes – Bertrand Curves - Spherical indicatrix - Intrinsic equations of space curves - Fundamental existence theorem for space curves - Helices.	18	Chalk & Talk
п	Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – The First Fundamental form – Direction coefficients on a surface – Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties	18	Chalk & Talk
ш	Geodesic and their differential equations – Canonical geodesic equations – Geodesics on surfaces of revolution – Normal property of geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic polar coordinates – Geodesic curvature – Gauss–Bonnet Theorem – Gaussian curvature – Surfaces of constant curvature.	18	Chalk & Talk
IV	The second fundamental form – Classification of points on a surface – Principal curvatures – Lines of curvature – The Dupin indicatrix– Developable surfaces – Developables associated with space curves – Developables associated with curves on surfaces – Minimal surfaces – Ruled surfaces	18	Chalk & Talk
V	Tensor notations – Gauss equations – Weingarten equations – Mainardi-Codazzi equations – Parallel surfaces.	18	Chalk & Talk

Course Designed by:

Dr. A. Arivu Chelvam Assistant Professor & Mrs. S. Ragavi, Assistant Professor

Learning Outcome Based Education & Assessment (LOBE)

Formative Examination - Blue Print									
Articulation Mapping – K Levels with Course Outcomes (COs)									
			Sectio	on A	Section	B	Section C	Ceeffer D	
Inte	Cas	V I arrol	MC	Qs	Short Ans	swers	Section C	Section D	
rnal	Cos	K Level	No. of.	K –	No. of.	К-	Elther or	Choice	
			Questions	Level	Questions	Level	Choice	Choice	
CI	CO1	Upto K2	2	K1&K2	1	K1	2	1	
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1	
CI	CO3	Upto K4	2	K1&K2	1	K2	2	1	
AII	CO4	Upto K4	2	K1&K2	2	K2	2	1	
		No. of	4						
		Questions to			3		4	2	
		be asked							
		No. of					2		
Que	stion	Questions to	4		3			1	
Pat	tern	be answered							
CIA I & II		Marks for	1		2		5	10	
		each question	1		2		5	10	
		Total Marks							
		for each	4		6		10	10	
		section							

	Distribution of Marks with K Level CIA I & CIA II								
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
СТА	K3			10	10	20	40	40	
	K4			10	10	20	40	40	
1	Marks	4	6	20	20	50	100	100	
	K1	2	2			4	8	20	
	K2	2	4			6	12	20	
CIA	K3			10	10	20	40	40	
II	K4			10	10	20	40	40	
	Marks	4	6	20	20	50	100	100	

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

5	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
Outcomes (COs)								
			MC	Qs	Short An	swers	Section C	Section D
S.No	COs	K - Level	No. of	K –	No. of	K –	(Either / or	(Open
			Questions	Level	Question	Level	Choice)	Choice)
1	CO1	Upto K2	2	K1&K2	1	K1	2(K2& K2)	1(K2)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)
No. of Questions to be		tions to be	10		5		10	5
	ASK	ea						
No. (of Ques	tions to be	10		5		5	3
answered		10		5		5	5	
Marks for each question		1		2		5	10	
Total Marks for each		10		10		25	30	
	secti	on	10		10		23	30
	(Figures in parenthesis denotes, questions should be asked with the given K level)							

Distribution of Marks with K Level									
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	17		
K2	5	6	20		31	9.17	1/		
K3			30	30	60	37.5	37		
K4				20	20	45.83	46		
Marks	10	10	50	50	120	100	100		
NB: Hig	NB: Higher level of performance of the students is to be assessed by attempting higher level								
of K lev	els.								

Section	A (Mu	iltiple Cho	ice Questions)				
Answei	r All Q	uestions	(10x1=10 marks)				
Q.No	CO	K Level	Questions				
1	CO1	K1					
2	CO1	K2					
3	CO2	K1					
4	CO2	K2					
5	CO3	K1					
6	CO3	K2					
7	CO4	K1					
8	CO4	K2					
9	CO5	K1					
10	CO5	K2					
Section	B (Sho	ort Answer	·s)				
Answei	r All Q	uestions	(5x2=10 marks)				
Q.No	$\frac{CO}{CO1}$	K Level	Questions				
11		KI K1					
12	$\frac{CO2}{CO2}$	KI K2					
13	<u>CO3</u>	K2 K2					
14	<u>CO4</u>	K2 K2					
15	$\frac{005}{0}$	K2					
Section		ner/Or Iy	$(5 \times 5 - 25 \text{ morely})$				
Allswei O No	$\frac{r \operatorname{AII} Q}{CO}$	K L ovol	$(5 \times 5 = 25 \text{ marks})$				
$\frac{\mathbf{V}}{16}$	$\frac{CO}{CO1}$	K Level	Questions				
10)a 16)b	$\frac{C01}{C01}$	K2					
10) 0 17) a	$\frac{CO1}{CO2}$	K2 K3					
17) a 17) h	$\frac{CO2}{CO2}$	K3					
18) a	CO3	K3					
18) b	CO3	K3					
19) a	CO4	K3					
19) b	CO4	K3					
20) a	CO5	K3					
20) b	CO5	K3					
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher				
level of	K leve	ls					
Section	D (Op	en Choice)					
Answei	Answer Any Three questions(3x10=30 marks)						
Q.No	CO	K Level	Questions				
21	CO1	K2					
22	CO2	K3					
23	CO3	K4					
24	CO4	K4					
25	CO5	K4					

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	STOCHASTIC PROCESSES								
Course Code	21PMTE44	21PMTE44							
Category	Category Elective				-	6			
Nature of cours	se: EMPLOYABILITY	SKILL ORIENTED	ENTREPI	RENU	JRSH	HIP			
COURSE OBJECTIVES:									
• To un	• To understand the concepts of Stochastic Process.								
To far	• To familiarize probability distributions.								
To lea	rn queuing models.								
• To un	derstand the discrete and continue	ous time Markov chains							
• To provide solutions in Stochastic Processes Models.									
Unit: I					1	8			
Stochastic Proce	esses: Some notions – Specification	on of Stochastic process	es – Station	ary p	roces	s –			
Markov Chains	– Definitions and examples – Hig	gher Transition Probabil	ities	• •					
Unit: II					1	8			
Markov Chains	: - Generalization of Independent	t Bernoulli trails- Seque	nce of chain	ı – De	epend	lent			
Trails – Classifi	cation of states and chains- Deter	rmination of higher tran	sition proba	bilitie	es –				
Stability of a Ma	arkov System	_	-						
Unit: III					1	8			
Graph Theoretic	Approach- Markov Chain with I	Denumerable Number of	f States- Re	ducib	le Ch	nains			
– Markov Chain	s with Continuous State Space								
Unit: IV	Unit: IV 18								
Markov Process	es with Discrete State Space : Po	isson Processes and thei	r extension	s - Pc	oissor	1			
process and rela	ted distribution – Generalization	of Poisson Process – Bi	rth and Dea	th Pro	cess	-			
Markov Process	es with Discrete State space (Co	ntinuous Time Markov	Chains)						
Unit: V					1	8			
Stochastic Proce	esses in Queuing – Queuing syste	m – General concepts –	the queuing	g mod	lel M	/ M /1			
– Steady state B	ehaviour – Transient Behaviour o	of M/M/1 Model – Non	Markovian	mode	ls –				
Transient Behav	viour of $M/M/1$ Model – Birth and	l Death Processes in Qu	eueing The	ory					
		Tot	tal Lecture	Hou	rs 9	0			
Books for Stu	dy:		• • • • •						
Medhi.J, Stocha	istic Processes, Wiley Eastern, 19	987, New Delhi. Reprin	t 2008	•					
Unit I-	Chapter 2 : Sections 2.1 t	2.3, Chapter 3 : Section	ons 3.1 to 3.1	2					
Unit II -	Chapter 3 : Sections 3.3 t	0 3.6							
Unit III -	Chapter 3 : Sections 3.7	to 3.11							
Unit IV -	Chapter 4 : sections 4.1 to	04.5							
Unit V -	Chapter 10 : sections 10.	.1 to10.4							
BOOKS IOF REI	erences:	-1.11	L !						
1. Basu.A.	K., Stochastic Process, Narosa Pl	ublisher, 2007, NewDell	$\frac{11}{2010}$						
2. Briat. B.	R, Stochastic Wodel, New Age I	D ragge Einst Edition	2010, Deim	reprii	nt.				
J. Efficient	ion 2013								
r ublicat.	1011,2013								
Academic Co	uncil Meeting Held On 17.05.2022			P	age 1	35			

Web Resources

- 1. <u>https://nptel.ac.in/courses/110/101/110101141/</u>
- 2. https://nptel.ac.in/courses/111/103/111103022/
- 3. <u>https://web.ma.utexas.edu/users/gordanz/notes/introduction_to_stochastic_processes.p_df</u>

COURSE OUTCOMES					
On the successful completion of the course , the students will be able to					
CO1:	Classify simple stochastic process models in the time domain.	K4			
CO2:	Apply the generalization of Poisson process	K3			
CO3:	Compare Markov and Erlang process	K4			
CO4:	Identify the qualitative and quantitative analysis of Stochastic process model.	K3			
CO5:	Explain models for real life problems.	K4			

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	Stochastic Processes: Some notions – Specification of Stochastic processes – Stationary process – Markov Chains – Definitions and examples – Higher Transition Probabilities	18	Chalk & Talk
II	Markov Chains : – Generalization of Independent Bernoulli trails- Sequence of chain – Dependent Trails – Classification of states and chains– Determination of higher transition probabilities – Stability of a Markov System	18	Chalk & Talk
ш	Graph Theoretic Approach- Markov Chain with Denumerable Number of States- Reducible Chains – Markov Chains with Continuous State Space	18	Chalk & Talk
IV	Markov Processes with Discrete State Space : Poisson Processes and their extensions – Poisson process and related distribution – Generalization of Poisson Process – Birth and Death Process- Markov Processes with Discrete State space (Continuous Time Markov Chains)	18	Chalk & Talk, PPT
V	Stochastic Processes in Queuing – Queuing system – General concepts – the queuing model M/M/1 – Steady state Behaviour – Transient Behaviour of M/M/1 Model – Non Markovian models – Transient Behaviour of M/M/1 Model – Birth and Death Processes in Queueing Theory	18	Chalk & Talk

Course Designed by:

Dr. P. Chitra Devi Assistant Professor & Mrs. R. Sumathi, Assistant Professor
			Learni	ng Outcome B	Based Educ	ation & As	sessment	t (LOBE)			
	Articulation Mapping – K Levels with Course Outcomes (COs)										
				Section	n A	Section B					
Inte rnal				MCC)s	Short An	swers	Section C	Section D		
	Cos		K Level	No. of. Questions	K - Level	No. of. Question S	K - Level	Either or Choice	Open Choice		
CI	CC)1	Upto K4	2	K1&K2	1	K1	2	1		
AI	CC)2	Upto K3	2	K1&K2	2	K2	2	1		
CI	CC)3	Upto K4	2	K1&K2	1	K2	2	1		
AII	CC)4	Upto K3	2	K1&K2	2	K2	2	1		
0		No. of Questions to be asked		4		3		4	2		
Ques n Datta	110	No. of Questions to be answered		4		3		2	1		
CIA	I	N	Aarks for each question	1		2		5	10		
	1	Т	otal Marks for each section	4		6		10	10		

	Distribution of Marks with K Level CIA I & CIA II										
		Section A	Section B	Section C	Section		% of				
	K	(Multiple	(Short	(Either /	D	Total	(Marks	Consolidate			
	Level	Choice	Answer	Or	(Open	Marks	without	of %			
		Questions)	Questions)	Choice)	Choice)		choice)				
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
СТА	K3			10	10	20	40	40			
	K4			10	10	20	40	40			
1	Marks	4	6	20	20	50	100	100			
	K1	2	2			4	8	20			
	K2	2	4			6	12	20			
CIA	K3			10	10	20	40	40			
II	K4			10	10	20	40	40			
	Marks	4	6	20	20	50	100	100			

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course										
	Outcomes (COs)										
		K-	MCQs		Short Ar	swers	Section C	Section D			
S.No	COs		No. of	K –	No. of	K –	(Either /	(Open			
		Level	Questions	Level	Question	Level	or Choice)	Choice)			
1	CO1	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)			
2	CO2	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)			
3	CO3	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)			
4	CO4	Upto K3	2	K1&K2	1	K2	2(K2&K2)	1(K3)			
5	CO5	Upto K4	2	K1&K2	1	K2	2(K2&K2)	1(K4)			
No. o	of Quest	ions to be	10		5		10	5			
	Aske	ed									
No. o	of Quest	ions to be	10		5		5	3			
	answe	red	10		5		5	5			
Mark	s for eac	h question	1		2		5	10			
Total Marks for each		10		10		25	30				
	sectio	on	10		10		25	30			
	(Figures	s in parenth	esis denotes,	questions	should be a	sked witl	h the given K	level)			

		Dis	stribution of	Marks with	n K Leve	1					
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %				
K1	5	4			9	7.5	42				
K2	5	6	30		41	34.2	42				
K3			20	20	40	33.3	33				
K4				30	30	25	25				
Marks	10	10	50	50	120	100	100				
NB: Hig of K lev	NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels										

Section	A (Mu	iltiple Cho	ice Questions)
Answei	r All Q	uestions	(10x1=10 marks)
Q.No	CO	K Level	Questions
1	CO1	K1	
2	CO1	K2	
3	CO2	K1	
4	CO2	K2	
5	CO3	K1	
6	CO3	K2	
7	CO4	K1	
8	CO4	K2	
9	CO5	K1	
10	CO5	K2	
Section	B (She	ort Answer	·s)
Answei	r All Q	uestions	(5x2=10 marks)
Q.No	CO	K Level	Questions
11	CO1	K1	
12	CO2	K1	
13	CO3	K2	
14	CO4	K2	
15	CO5	K2	
Section	C (Eit	her/Or Ty	pe)
Answei	r All Q	uestions	(5 x 5 = 25 marks)
Q.No	CO	K Level	Questions
16) a	CO1	K3	
16) b	CO1	K3	
17) a	CO2	K2	
17) b	CO2	K2	
18) a	CO3	K3	
18) b	CO3	K3	
19) a	CO4	K2	
19) b	CO4	K2	
20) a	CO5	K2	
20) b	CO5	K2	
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher
level of	K leve	ls	
Section	D (Op	en Choice)	
Answei	r Any 'l	nree ques	uons (3x10=30 marks)
Q.No		K Level	Questions
21		K4 K2	
22	CO2	K3	
23	CO3	K4	
24	CO4	K3	
25	005	K4	

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	FLUID DYNAMICS								
Course Code	21PMTE45			L	Р	С			
Category	Elective			6	-	6			
Nature of cours	e: EMPLOYBILITY	SKILL ORIENTED	ENTREPH	RENU	RSH	IIP			
COURSE OBJ	ECTIVES:								
To learn the phy	sical properties of fluids								
To relate the pri	nciples of continuity, moment	ntum and energy as applied to	o fluid moti	ons.					
To know the concept on the Kinematics of fluid motions,									
To understand three dimensional flows.									
To know the two	dimensional flows								
Unit: I					1	8			
General orthogo	nal curvilinear coordinates-	Arc length in Orthogonal coo	ordinates-G	radiei	nt in				
orthogonal coor	linates-Divergence in ortho	gonal coordinates-Laplacian	in orthogor	nal co	ordin	ates			
– Curl of a vecto	r function in orthogonal coo	ordinates -worked examples -	-Some carte	esian	tenso	r			
notation.									
Unit: II					1	8			
Real fluids and I	deal fluids – Velocity of a f	luid at apoint –Streamlines ar	nd Path line	s, stea	ady a	nd			
unsteady flows -	unsteady flows – The velocity potential – The vorticity vector –Local and particle rates of change –								
The equation of	continuity – worked examp	les – Acceleration of a fluid–	Conditions	at a ri	gid				
boundary.									
Unit: III					1	8			
Pressure at a poi	nt in a fluid at rest – Pressu	e at a point in a moving fluid	l – Conditio	ns at	a .				
boundary of two	in viscid Immiscible fluids	 Euler"sequations of motion 	n – Bernoul	li''s eo	quation	on –			
worked example	s – discussion of the case of	steady motion under conserv	ative body	forces	-so	me			
flows involving	axial symmetry – Some spe	cial two-dimensional flows–I	mpulsive m	notion	•	-			
Unit: IV					1	8			
Some Three-Dir	nensional flows: Introductio	n– Sources, Sinks and double	ets–Images	in rig	id inf	inite			
plane–Images in	solid spheres-Axi-Symmet	ric flows, Stoke's Stream fun	iction.						
Unit: V					1	8			
Meaning of Two	-Dimensional Flow – Use o	of Cylindrical Polar coordinat	es – The str	eam f	unct	ion–			
The complex po	tential for Two–Dimensiona	ll Irrotational, In compressibl	e flow–Cor	nplex	velo	city			
potentials for sta	ndard two dimensional flow	vs–Some worked examples –	Two-Dimer	isiona	l ima	ıge			
systems-The Mi	ne-Thomson circle theorem	l							
		Tot	al Lecture	Hou	s 9	0			
Books for Stud			1.5.1	P					
Frank Chorlton,	2004, Textbook of Fluid D	ynamics, CBS Publishers an	d Distributo	ors Pv	t. Lto	1.			
New Delhi									
Unit I-Chapter1	Section 1.19to 1.20)								
Unit II - Chapte	2(Section2.1 to2.10)								
Unit III -Chapte	r3(Section 3 1to3 7 3 9to 3	11)							
Unit IV -Chapte	r4(Section 4.1 to 4.5)	/							
enn i enupte									

Academic Council Meeting Held On 17.05.2022

Unit V - Chapter5(Section5.1 to5.8)

Books for References:

1.Goyal J.K. and Gupta K.P.,1998, **Fluid Dynamics**, Seventh Edition, Pragati Prakashan Publications, Meerat.

2. Paterson A.R.,1977,**A First Course in Fluid Dynamics**, Cambridge University Press, India (Pvt)Ltd.

3. Raisinghania M.D.,2006, Fluid Dynamics, S. Chand & Company Ltd, New Delhi.

Web Resources

1. <u>http://www3.dicca.unige.it/rrepetto/linked-files/fluid-dynamics-lecture-notes.pdf</u>

- 2. <u>https://www.iare.ac.in/sites/default/files/AERO_FLUID_DYNAMICS_LECTURE_NOTES.pdf</u>
- 3. http://mdudde.net/pdf/study_material_DDE/M.Sc.MAthematics/Fluid_Dynamics_final.pdf

COUR	SE OUTCOMES	K Level						
On the	On the successful completion of the course , the students will be able to							
CO1:	Find the gradient, divergence, curl of orthogonal coordinates	K3						
CO2:	Identify the Euler's equations of motion and equations of continuity	K3						
CO3:	Solve the equations of motion of a fluid when it is at rest and in motion	K3						
CO4:	Analyze two dimensional and three dimensional flows	K4						
CO5:	Examine Two–Dimensional flow using cylindrical Polar coordinates	K4						

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
Ι	General orthogonal curvilinear coordinates–Arc length in Orthogonal coordinates–Gradient in orthogonal coordinates–Divergence in orthogonal coordinates–Laplacian in orthogonal coordinates – Curl of a vector function in orthogonal coordinates – worked examples – Some cartesian tensor notation.	18	Chalk & Talk
П	Real fluids and Ideal fluids – Velocity of a fluid at a point – Streamlines and Path lines, steady and unsteady flows – The velocity potential – The vorticity vector –Local and particle rates of change – The equation of continuity – worked examples – Acceleration of a fluid–Conditions at a rigid boundary.	18	Chalk & Talk
III	Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Conditions at a boundary of two in viscid Immiscible fluids – Euler's equations of motion – Bernoulli's equation – worked examples – discussion of the case of steady motion under conservative body forces– some flows involving axial symmetry – Some special two-dimensional flows–Impulsive motion.	18	Chalk & Talk
IV	Some Three-Dimensional flows: Introduction– Sources, Sinks and doublets–Images in rigid in finite plane–Images in solid spheres–Axi-Symmetric flows, Stoke's Stream function.	18	Chalk & Talk
V	Meaning of Two-Dimensional Flow – Use of Cylindrical Polar coordinates – The stream function– The complex potential for Two– Dimensional Irrotational, In compressible flow–Complex velocity potentials for standard two dimensional flows–Some worked examples –Two-Dimensional image systems-The Milne- Thomson circle theorem.	18	Chalk & Talk

Course Designed by:

Dr. P. Chitra Devi Assistant Professor & Dr. S. Andal, Assistant Professor

	Learning Outcome Based Education & Assessment (LOBE)										
	Formative Examination - Blue Print										
	Articulation Mapping – K Levels with Course Outcomes (COs)										
			Section A		Section B		Section C	Section D			
Inte	Cos	K L ovol	MC	Qs	Short Ans	swers	Fither or	Open			
rnal	COS	K Level	No. of.	К -	No. of.	К-	Choice	Choice			
			Questions	Level	Questions	Level	Choice	Choice			
CI	CO1	Upto K3	2	K1&K2	1	K1	2	1			
AI	CO2	Upto K3	2	K1&K2	2	K2	2	1			
CI	CO3	Upto K3	2	K1&K2	1	K2	2	1			
AII	CO4	Upto K4	2	K1& K2	2	K2	2	1			
		No. of									
		Questions to	4		3		4	2			
		be asked									
		No. of									
Que	stion	Questions to	4		3		2	1			
Pat	tern	be answered									
CIA	I & II	Marks for	1		2		5	10			
		each question	1		2		5	10			
		Total Marks									
		for each	4		6		10	10			
		section									

		D	istribution of	Marks wit	h K Level (CIAI&(CIA II	
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
1	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course									
	S.No COs		MC	Qs	(COS) Short Answers		Section C	Section D		
S.No		K - Lovol	No. of	K –	No. of	К –	(Either /	(Open		
		Level	Questions	Level	Question	Level	or Choice)	Choice)		
1	CO1	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)		
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)		
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)		
4	CO4	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
5	CO5	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)		
No.	of Questi Aske	ons to be d	10		5		10	5		
No.	of Questi answer	ons to be ed	10		5		5	3		
Mark	ks for eacl	n question	1		2		5	10		
Total Marks for each section		10		10		25	30			
	(Figures	in parenthe	esis denotes,	questions s	hould be as	ked with	n the given K	level)		

	Distribution of Marks with K Level							
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %	
K1	5	4			9	7.5	17	
K2	5	6			11	9.17	17	
K3			25	20	45	37.5	37	
K4			25	30	55	45.83	46	
Marks	10	10	50	50	120	100	100	
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.								

Section A (Multiple Choice Questions)					
Answei	r All Q	uestions	(10x1=10 marks)		
Q.No	CO	K Level	Questions		
1	CO1	K1			
2	CO1	K2			
3	CO2	K1			
4	CO2	K2			
5	CO3	K1			
6	CO3	K2			
7	CO4	K1			
8	CO4	K2			
9	CO5	K1			
10	CO5	K2			
Section	B (Sho	ort Answer	rs)		
Answei	r All Q	uestions	(5x2=10 marks)		
Q.No	CO	K Level	Questions		
11	CO1	K1			
12	CO2	K1			
13	CO3	K2			
14	CO4	K2			
15	CO5	K2			
Section	C (Eit	her/Or Ty	pe)		
Answei	r All Q	uestions	(5 x 5 = 25 marks)		
Q.No	CO	K Level	Questions		
16) a	CO1	K2			
16) b	COI	K2			
17) a	CO2	K3			
17) b	CO2	K3			
18) a	CO3	K3			
18) b	CO3	K3			
19) a	CO4	K3			
19) b	CO4	K3			
20) a	CO5	K3			
20) b	<u>CO5</u>	K3			
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher		
level of	K leve				
Section	D (Op	en Choice) (210, 20		
Answei	r Any I	I I I I areal	uons (3x10=30 marks)		
Q.N0	CO1	K Level	Questions		
21	CO1	NJ V2			
22	CO_2	KJ V2			
23	CO_4	KJ VA			
24	CO4	<u>N4</u> <u>V</u> 4			
23	005	N 4			

Summative Examinations - Question Paper – Format



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS) DEPARTMENT OF MATHEMATICS (For those who joined in 2021-2022 and after)

Course Name	M	MULTIVARIABLE CALCULUS						
Course Code	21	PMTE46			L	Р	С	
Category	El	lective 6 - 6						
Nature of cours	e:	EMPLOYABILITY	SKILL ORIENTED	ENTREP	REN	URS	HIP	
COURSE OBJI	ECI	TIVES:						
To have basic	ide	as of Sequences, Continuity	y and Limits					
• To learn Partia	al ai	nd Total Differentiation						
• To prove Tay	lor's	s theorem and do Chain rule	e					
• To know the a	nnl	ications of Partial Different	iation					
To solve Mult	inle	Integration						
Unit. I	ipic					1	8	
Sequences in \mathbb{R}^2	Su	bsequences and Cauchy sec	wences - Closure boundary	and interio	r Con	tinuit	V	
Composition of co	- Su ntir	vous functions Character	rizations of continuity Con	and interio		unun	Ly —	
and boundedness		ontinuity and monotonicity	Continuity and convexity	Continuit	v and			
and boundedness -	- Cl	minutry and monotometry	- Continuity and convexity		y anu			
Intermediate value	e pro	operty - Uniform continuity	– Limits and continuity.					
Unit: II						1	8	
Partial and Directi	ona	l Derivatives – Partial deriv	vatives – Directional derivation	ives – High	er-ord	er		
partial derivatives	- P	roblems		-				
Unit: III						1	8	
Differentiability -	Dif	ferentiability and directives	s – Implicit differentiation –	Taylor's th	eorem	and		
				2				
Chain rule – Funct	tion	s of three variables – Proble	ems			1	0	
Unit: IV	0			.	1		8	
Absolute extrema	– C	onstrained extrema –Local	extrema and saddle points –	- Linear and	quadi	catic		
approximations						<u> </u>	0	
Unit: V							8	
Double integrals o	n re	ctangles – Basic inequality	and criterion for integrabili	ty – Doman	n addi	tıvıty	' on	
rectangles - Integr	abil	ity of monotonic and contin	nuous functions – Algebraic	and order p	ropert	ties –		
Fundamental theorem	rem	of calculus – Fubini's theo	rem on rectangles.					
			То	tal Lecture	Hou	rs 9	0	
Books for Study:	_				~ .			
S.R. Ghorpadeand	В.	V. Limaye, "A Course in I	Multivariable Calculus and	d Analysis,	Sprin	ger,		
2017.								
	_							
UNIT I – Chapter	2	Pages 43 – 52, 55 – 63, 67	7 – 71					
UNIT II - Chapte	er 3	Pages 83 – 99						
UNIT III – Chap	UNIT III – Chapter 3 Pages 101 – 124, 138 – 156							
UNIT IV – Chapter 4 Pages 157 – 184								
UNIT V – Chapter 5 Pages 185 – 225								
Books for Refere	nces							
1. Spivak, Calcult	15 0	n ivianiiolas, 5th Edition, (-KU Press, 1965.	010				
2. J. L. Taylor, Fo	und	ations of Analysis, Americ	can Mathematical Society, 2	.012.				
5. W. Kudin, Prin	cıpl	es of Mathematical Analy	rsis, 3rd Edition, McGraw H	III BOOK CO).,			
Kogaskusha, 1976).							
Web Resources		Web Resources						

Academic Council Meeting Held On 17.05.2022

1.	https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall	-
	2007/lecture-notes/	
2.	https://www.tutorialsduniya.com/notes/multivariate-calculus-notes/	
3.	https://www.math.nyu.edu/~cerfon/calculusIII.html	
COUR	SE OUTCOMES	K Level
On the	successful completion of the course , the students will be able to	
CO1:	Apply derivatives of functions of two or more variables	K3
CO2:	Solve the gradient and directional derivatives for a function at a given point.	K3
CO3:	Find the total differential of a function of several variables	K3
CO4.	Solve a function of two or more variables, organizing work into main steps	V2
04:	carefully justifying determination of critical points.	NJ
CO5.	Analyse multiple integrals either by using iterated integrals or approximation	K/
005:	methods.	N 4

CO & PO Mappings:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	1	1	1
CO 2	3	3	2	2	1	-
CO 3	3	3	3	1	1	1
CO 4	3	3	2	2	1	-
CO 5	3	3	2	2	2	1

*3 – Advanced Application; 2 – Intermediate Development; 1 - Introductory Level

LESSON PLAN

UNIT	SUBJECT NAME	Hours	Pedagogy
I	Sequences in \mathbb{R}^2 – Subsequences and Cauchy sequences – Closure, boundary and interior Continuity – Composition of continuous functions – Characterizations of continuity – Continuity and boundedness – Continuity and monotonicity – Continuity and convexity – Continuity and Intermediate value property - Uniform continuity-– Limits and continuity.	18	Chalk & Talk
II	Partial and Directional Derivatives – Partial derivatives – Directional derivatives – Higher-order partial derivatives – Problems	18	Chalk & Talk
ш	Differentiability – Differentiability and directives – Implicit differentiation – Taylor's theorem and Chain rule – Functions of three variables – Problems	18	Chalk & Talk
IV	Absolute extrema – Constrained extrema –Local extrema and saddle points – Linear and quadratic approximations	18	Chalk & Talk
V	Double integrals on rectangles – Basic inequality and criterion for integrability – Domain additivity on rectangles - Integrability of monotonic and continuous functions – Algebraic and order properties – Fundamental theorem of calculus – Fubini's theorem on rectangles.	18	Chalk & Talk

Course Designed by:

Mrs. S. Ragavi, Assistant Professor & Dr. M. Saravanan, Assistant Professor

Academic Council Meeting Held On 17.05.2022

	Learning Outcome Based Education & Assessment (LOBE)								
	Formative Examination - Blue Print								
	Articulation Mapping – K Levels with Course Outcomes (COs)								
				Sectio	on A	Section	n B	Section	Section
Inte	Co	G	K I ovol	MC	Qs	Short Ans	swers	С	D
rnal	CO	8	K Level	No. of.	K -	No. of.	K -	Either or	Open
				Questions	Level	Questions	Level	Choice	Choice
CI	CO	1	Upto K3	2	K1&K2	1	K1	2	1
AI	CO	2	Upto K3	2	K1&K2	2	K2	2	1
CI	CO	3	Upto K3	2	K1&K2	1	K2	2	1
AII	CO	4	Upto K4	2	K1&K2	2	K2	2	1
		N	No. of Questions	4		3		4	2
01106	tio		to be asked	-		5			
Quea	500	N	No. of Questions	4		3		2	1
Dotte	o rn	1	to be answered	-		5			
	I &	-	Marks for each	1		2		5	10
	I U	question		1		4		5	10
		Total Marks for		4		6		10	10
			each section			U		10	10

	Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
	K1	2	2			4	8	20
	K2	2	4			6	12	20
СТА	K3			10	10	20	40	40
	K4			10	10	20	40	40
L	Marks	4	6	20	20	50	100	100
	K1	2	2			4	8	20
	K2	2	4			6	12	20
CIA	K3			10	10	20	40	40
II	K4			10	10	20	40	40
	Marks	4	6	20	20	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

S	Summative Examination – Blue Print Articulation Mapping – K Level with Course							
			МС	Qs	(COS) Short Answers		Section C	Section D
S.No	COs	K -	No. of	K –	No. of	K –	(Either /	(Open
		Level	Questions	Level	Question	Level	or Choice)	Choice)
1	CO1	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
2	CO2	Upto K3	2	K1&K2	1	K1	2(K3&K3)	1(K3)
3	CO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)
5	CO5	Upto K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
No.	of Questi Aske	ons to be d	10		5		10	5
No. of Questions to be answered		10		5		5	3	
Marks for each question			1		2		5	10
Total Marks for each section		10		10		25	30	
	(Figures	in parenthe	sis denotes,	questions s	hould be as	ked witl	n the given K	level)

	Distribution of Marks with K Level								
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %		
K1	5	4			9	7.5	17		
K2	5	6			11	9.17	1/		
K3			25	20	45	37.5	37		
K4			25	30	55	45.83	46		
Marks	10	10	50	50	120	100	100		
NID TT	1 1 1 0		A (1)	• • •					

NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.

Section A (Multiple Choice Questions)					
Answei	r All Q	uestions	(10x1=10 marks)		
Q.No	CO	K Level	Questions		
1	CO1	K1			
2	CO1	K2			
3	CO2	K1			
4	CO2	K2			
5	CO3	K1			
6	CO3	K2			
7	CO4	K1			
8	CO4	K2			
9	CO5	K1			
10	CO5	K2			
Section	B (Sho	ort Answer	rs)		
Answei	r All Q	uestions	(5x2=10 marks)		
Q.No	CO	K Level	Questions		
11	CO1	K1			
12	CO2	K1			
13	CO3	K2			
14	CO4	K2			
15	CO5	K2			
Section	C (Eit	her/Or Ty	pe)		
Answei	r All Q	uestions	(5 x 5 = 25 marks)		
Q.No	CO	K Level	Questions		
16) a	CO1	K3			
16) b	CO1	K3			
17) a	CO2	K3			
17) b	CO2	K3			
18) a	CO3	K3			
18) b	CO3	K3			
19) a	CO4	K3			
19) b	CO4	K3			
20) a	CO5	K3			
20) b	CO5	K3			
NB: Hi	gher le	vel of perf	ormance of the students is to be assessed by attempting higher		
level of	K leve	ls			
Section	D (Op	en Choice)			
Answei	r Any 'l	hree ques	tions (3x10=30 marks)		
Q.No		K Level	Questions		
21		K3			
22	CO2	K3 K2			
23	CO3	K3 1/2			
24	CO4	K3			
25	005	К4			

Summative Examinations - Question Paper – Format