

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 $CGPA = \frac{\sum(Marks \times credits)}{\sum(Credits)}$

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.

The scheme of Examination

The components for continuous internal assessment are:

Two tests and their average	--15 marks
Seminar /Group discussion	--5 marks
Assignment	--5 marks

Total	25 Marks

Pattern of the questions paper for the continuous Internal Assessment

(For Part III, Elective & NME Paper)

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

Pattern of the question paper for the Summative Examinations:

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 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 provide an environment where students can learn and become competent users of mathematics and mathematics applications

The 12 Graduate Attributes*:

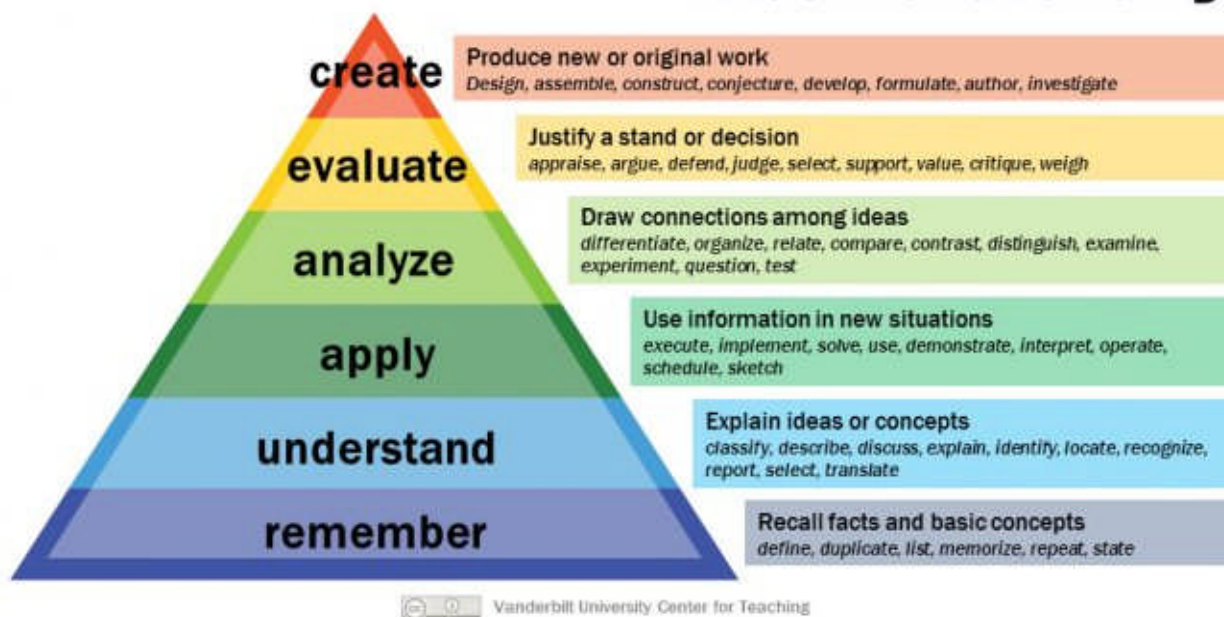
1. (KB) A knowledge base for engineering: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.
2. (PA) Problem analysis: An ability to use appropriate knowledge and skills to identify, formulate, 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 sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.	A knowledge base for engineering
2	An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions	Problem analysis
3	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.	Investigation
7	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.	Communication skills
6	An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.	Individual 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 changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge	Life-long learning

Bloom's Taxonomy



PROGRAM EDUCATIONAL OBJECTIVE (PEOs) are:

PEO1:	Enhance the entrepreneurial abilities, life skills and research initiatives through experiential learning practices and building self confidence
PEO2:	Collaborate with industry and alumnae to explore the new avenues in respective domains and raise the employability ratio
PEO3:	Equip with soft skills and critical thinking to produce an erudite and trustworthy generation to fit into versatile situations
PEO4:	Adhere to the ethical and environmental sustainability to create morally upright and empowered citizens to face industry/ Institution

M. Sc., Mathematics Programme Outcomes

At the end of the programme, the students will be able to

S. No	Programme Outcomes	Graduate Attributes
1	Demonstrate analytical and practical knowledge in the field of Science and Technology.	Disciplinary Knowledge
2	Express their disciplinary knowledge with others effectively in both oral and written form in an organized manner.	Communication Skills
3	Make proficiency by using Computer Technology in learning activities and update their knowledge, skills to fulfill the requirements at the workplace in their life span.	Digital Literacy & Life-long Learning
4	Employ critical and analytical thinking in understanding the concepts of Mathematical & Computing Sciences and qualify competitive examinations CSIR NET/ SET/ TET.	Analytical Reasoning & Critical Thinking
5	Identify Mathematical and Computational methods in order to solve critical problems.	Problem Solving
6	Work independently and do detailed study of various concepts of Science.	Self-directed learning
7	Plan, execute, report the results of an experiment/investigation together as a group/team with interest and work efficiently as a member of a team.	Research-related skills and Team work

M. Sc. Mathematics Programme Specific Outcomes

At the end of the Programme, the students will be able to

S. No	Programme Specific Outcomes	Graduate Attributes
1	Demonstrate the understanding of mathematical concepts in the field of Science and Technology.	Disciplinary Knowledge
2	Express their mathematical knowledge with others effectively in both oral and written form in an organized manner.	Communication Skills
3	Proficient in using digital learning platforms and update their knowledge, skills to fulfill the requirements at the workplace in their life span.	Digital Literacy & Life-long Learning
4	Employ critical and analytical thinking in understanding the concepts of Mathematical Science and in appearing Competitive examinations SET/ NET/ TET.	Analytical Reasoning & Critical Thinking
5	Choose appropriate mathematical and computational methods in order to solve different types of problems.	Problem Solving
6	Work independently and do detailed study of various concepts of Science.	Self-directed learning
7	Plan, execute, report the results of an experiment/investigation with the highest standard of ethics in research and work efficiently as a team member / leader.	Research-related skills and Team work

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

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

Course Code	Title of the Course	Hours	Credits	Maximum Marks		
				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 SEMESTER						
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 SEMESTER						
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 SEMESTER						
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





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

Course Name	ALGEBRA				
Course Code	21PMTTC11	L	P	C	
Category	Core	6	-	4	
Nature of course:	EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPRENURSHIP	
Course Objectives:					
<ul style="list-style-type: none"> • To introduce the advanced ideas in Group theory. • To familiarize Abelian groups and Ring theory. • To know about unique factorization domain. • To equip the students in fields and ideals. • To know about Euclidean rings, Polynomial rings. 					
Unit: I					18
Groups (Definitions only) – Subgroups - A Counting Principle - Normal subgroups and Quotient groups - Permutation groups.					
Unit: II					18
Another Counting Principle - Sylow's Theorems - Direct Products – Finite Abelian Groups					
Unit: III					18
Ideals and Quotient Rings - More Ideals and Quotient Rings, The Field of Quotients of an Integral Domain					
Unit: IV					18
Euclidean Rings - A particular Euclidean Rings.					
Unit: V					18
Polynomial rings - Polynomials over the rational field - Polynomial rings over Commutative rings.					
Total Lecture Hours					90
Books for Study: I. N. Herstein, Topics in Algebra , Second Edition, John Wiley and Sons, New Delhi, Reprint 2010.					
Unit I - Chapter 2: Sections 2.1, 2.4, 2.5, 2.6, 2.10 Unit II - Chapter 2: Sections 2.11, 2.12, 2.13, 2.14					

Unit III- Chapter 3: Sections 3.4, 3.5, 3.6,
 Unit IV - Chapter 3: Sections 3.7, 3.8
 Unit V - Chapter 3: Sections 3.9,3.10,3.11.

Books for References:

1. Joseph A Gallian, *Contemporary Abstract Algebra*, 8th Edition, Cengage Learning India Private Limited, New Delhi, 2013.
2. Thomas W.Hungerford, *Algebra*, Springer International Edition, Newyork, 2009.
3. Lang Serge ,*Algebra* , Addison – Welsey,2002

Web Resources

https://www.youtube.com/watch?v=PN-cro0J_v8&list=PLEAYkSg4uSQ1Yhxu2U-BxtRjZElrfVVcO
<https://nptel.ac.in/courses/111/106/111106113/>
<http://www.freebookcentre.net/maths-books-download/Notes-on-Abstract-Algebra-by-John-Perry.html>

COURSE OUTCOMES **K Level**

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

CO1:	Demonstrate the understanding of group, normal groups, quotient group and permutation groups.	K2
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	PO 7
CO 1	3	2	1	1	3	2	1
CO 2	3	2	1	-	2	2	2
CO 3	2	3	-	1	2	1	-
CO 4	2	3	1	1	3	2	2
CO 5	2	2	1	1	2	1	2

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	Groups (Definitions only) – Subgroups - A Counting Principle - Normal subgroups and Quotient groups - Permutation groups	18	Chalk & Talk
II	Counting Principle -Sylow’s Theorems - Direct Products –Finite Abelian Groups.	18	Chalk & Talk
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								
Articulation Mapping – K Levels with Course Outcomes (COs)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of. Questions	K - Level	No. of. Questions	K - Level		
CI AI	CO1	Upto K2	2	K1 & K2	1	K1	2	3
	CO2	Upto K3	2	K1 & K2	2	K2	2	3
CI AII	CO3	Upto K4	2	K1 & K2	1	K2	2	3
	CO4	Upto K4	2	K1 & K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MOQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions (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 (Either/Or Type)			
Answer All Questions (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	

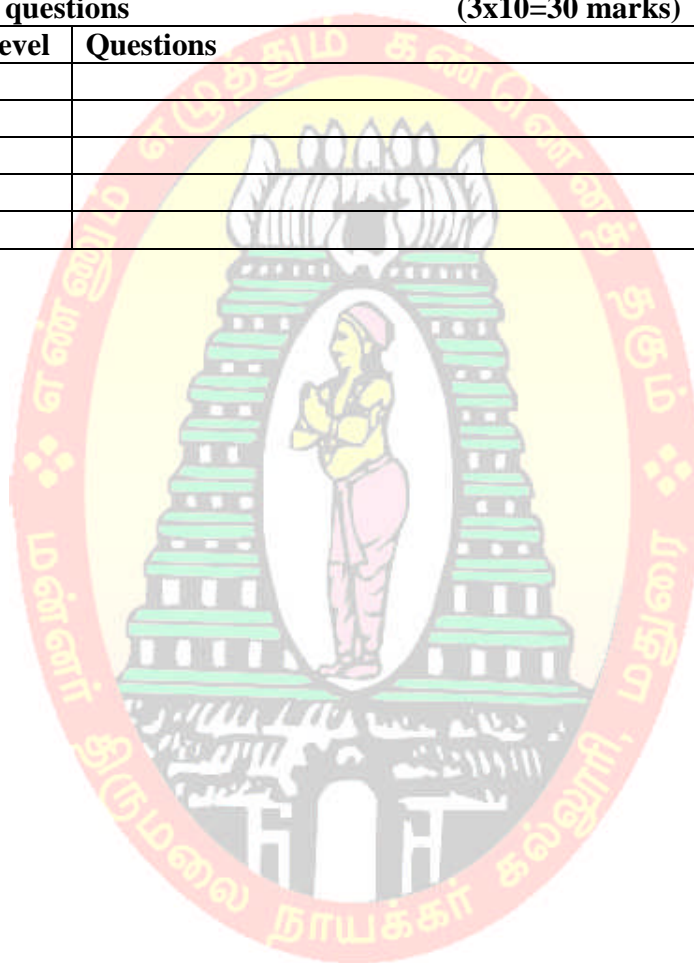
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels

Section D (Open Choice)

Answer Any Three questions

(3x10=30 marks)

Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K4	
23	CO3	K3	
24	CO4	K5	
25	CO5	K4	





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

Course Name	ANALYSIS					
Course Code	21PMTTC12	L	P	C		
Category	Core	6	-	4		
Nature of course:	EMPLOYABILITY	✓	SKILL ORIENTED	✓	ENTREPRENURSHIP	✓
Course objectives:						
<ul style="list-style-type: none"> • 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 Calculus. • To introduce the concept of Riemann integral. • To get an idea about the Sequences and Series of functions. 						
Unit: I					18	
Limits of Functions - Continuous Functions - Continuity and Compactness - Continuity and Connectedness – Discontinuities - Monotonic Functions - Infinite Limits and Limits at Infinity.						
Unit: II					18	
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						
Unit: III					18	
The Riemann-Stieltjes Integral- Definition and Existence of the Integral - Properties of the Integral - Integration and Differentiation - Integration of Vector valued functions -Rectifiable Curves.						
Unit: IV					18	
Sequence and Series of functions – Uniform convergence - Uniform convergence and Continuity - Uniform convergence and Integration						
Unit: V					18	
Uniform Convergence and Differentiation – Equi-continuous Families of Functions - The Stone - Weierstrass Theorem						
Total Lecture Hours					90	
Books for Study:						
Walter Rudin, Principles of Mathematical Analysis - McGraw Hill International Editions, Mathematics series, Third Edition (1976).						
Unit I : Chapter 4 Section 4.1 – 4.34						
Unit II: Chapter 5 Section 5.1 – 5.19						

Unit III: Chapter 6 Section 6.1 – 6.27

Unit IV :Chapter 7 Section 7.1 – 7.15

Unit V: Chapter 7 Section 7.16 – 7.26

Books for References:

1. Patrick M. Fitzpatrick, **Advanced Calculus**, AMS, Pine and Applied Undergraduate Texts, Indian Edition, 2006.
2. Apostol, **Mathematical Analysis**, Narosa Publishing House, Indian edition, 1974.
3. H.L. Royden, **Real Analysis**, Third Edition, OHI Learning Pvt Ltd., 3rd Edition, New Delhi, 2009.

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 Level

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	K3
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:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	-	2	-	2	-
CO 2	3	2	1	1	-	-	-
CO 3	3	2	-	2	2	2	1
CO 4	2	3	1	2	-	-	-
CO 5	2	1	-	1	-	-	2

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	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)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of. Questions	K - Level	No. of. Questions	K - Level		
CI AI	CO1	Upto K2	2	K1 & K2	1	K1	2	3
	CO2	Upto K3	2	K1 & K2	2	K2	2	3
CI AII	CO3	Upto K4	2	K1 & K2	1	K2	2	3
	CO4	Upto K4	2	K1 & K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MOQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions (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 (Either/Or Type)			
Answer All Questions (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	

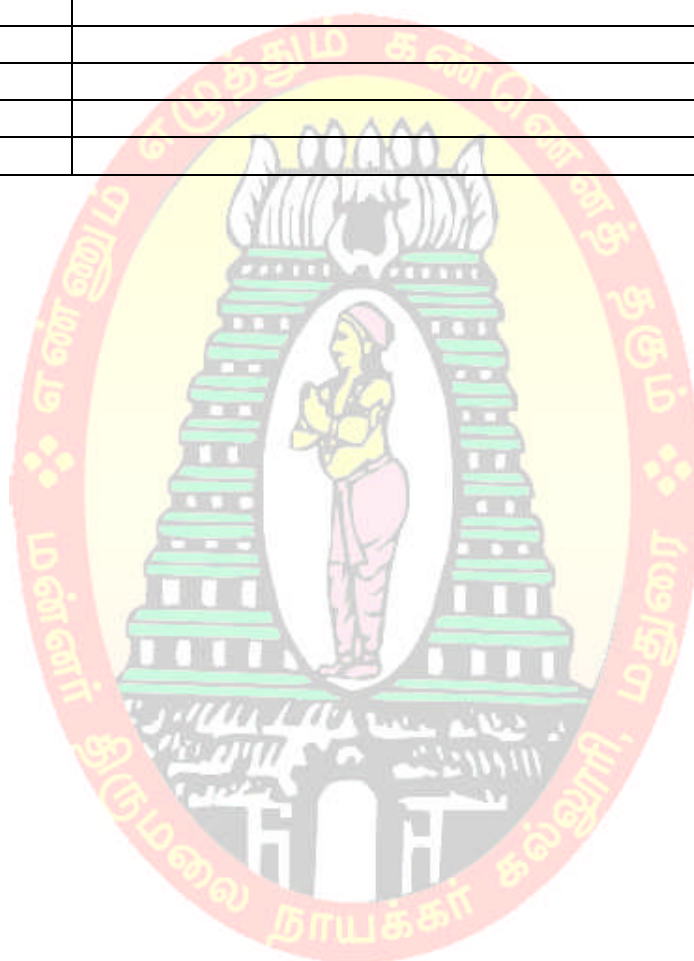
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels

Section D (Open Choice)

Answer Any Three questions

(3x10=30 marks)

Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K3	
24	CO4	K4	
25	CO5	K5	





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

Course Name	ORDINARY DIFFERENTIAL EQUATIONS				
Course Code	21PMTTC13	L	P	C	
Category	Core	6	-	4	
Nature of course:	EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPRENURSHIP	
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • To produce knowledge on ODEs. • To familiarize with power series solution, special functions. • To learn about existence and uniqueness of solutions. • To solve homogenous and non-homogenous equations. • To solve standard type of OD equations. 					
Unit: I					18
Second order homogeneous equation, Initial Value Problem, Linear Dependence and Independence, A formula for Wronskian, Non-homogeneous equation of order two.					
Unit: II					18
Homogeneous equation of order n, Initial value problems, Annihilator method to solve non-homogeneous equation, algebra of constant coefficient operators.					
Unit: III					18
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.					
Unit: IV					18
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) .					
Unit: V					18
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.					
Total Lecture Hours					90
Books for Study:					
E.A.Coddington, An Introduction to Ordinary Differential Equation , PHI Learning Private Limited, New Delhi, 2010.					
Unit I - Chapter 2 : Section 1 to 6					
Unit II - Chapter 2 : Section 7 to 12					

Unit III - Chapter 3: Section 1 to 8
 Unit IV - Chapter 4: Section 1 to 8
 Unit V - Chapter 5: Section 1 to 8

Books for References:

1. M.Rama Mohan Rao, **Ordinary Differential Equations Theory and Applications**, 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>

COURSE 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	K4
CO2:	Solve homogenous equation and non-homogenous equation with constant co-efficient	K3
CO3:	Develop the concepts of ordinary differential equation for homogeneous and non-homogenous equations.	K3
CO4:	Demonstrate the understanding of power series and special functions	K2
CO5:	Compute the solution by iterative procedure for exact equation.	K3

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	1	-	3	1	-
CO 2	2	-	2	2	2	2	1
CO 3	2	2	2	-	3	1	-
CO 4	2	-	-	-	1	2	-
CO 5	3	-	2	1	2	2	2

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	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)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of. Questions	K - Level	No. of. Questions	K - Level		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	3
AI	CO2	Upto K3	2	K1&K2	2	K2	2	3
CI	CO3	Upto K4	2	K1&K2	1	K2	2	3
AII	CO4	Upto K4	2	K1&K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MOQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions) Answer 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 (Short Answers) Answer All Questions (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 (Either/Or Type) Answer All Questions (5 x 5 = 25 marks)			
Q.No	CO	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	

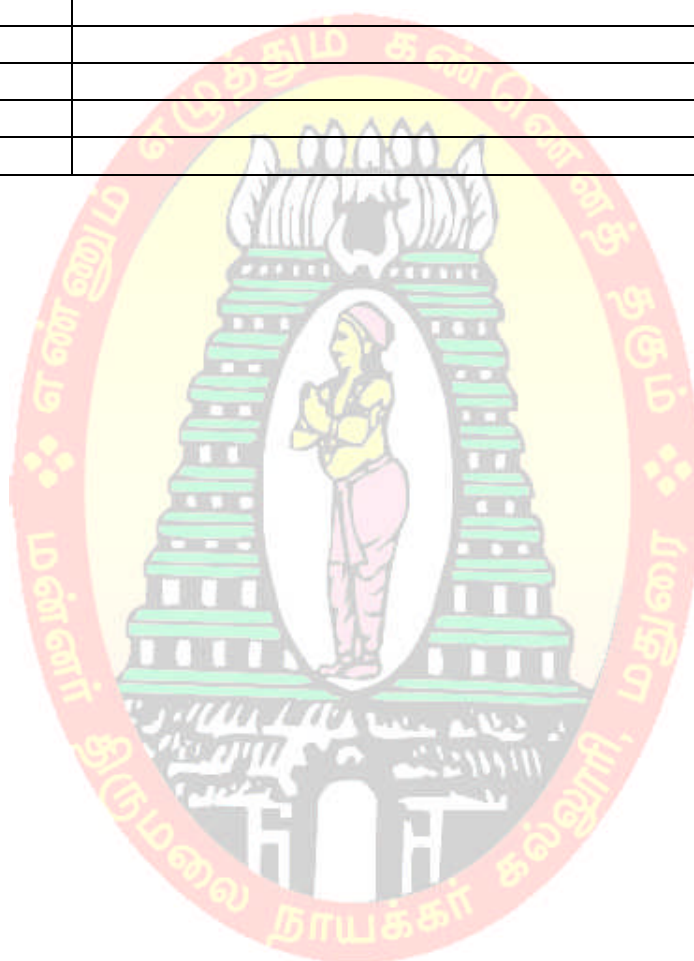
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels

Section D (Open Choice)

Answer Any Three questions

(3x10=30 marks)

Q.No	CO	K Level	Questions
21	CO1	K4	
22	CO2	K3	
23	CO3	K3	
24	CO4	K2	
25	CO5	K3	





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

Course Name	GRAPH THEORY AND ITS ALGORITHMS			
Course Code	21PMTTC14	L	P	C
Category	Core	6	-	4
Nature of course:	EMPLOYABILITY	<input checked="" type="checkbox"/>	SKILL ORIENTED	ENTREPRENURSHIP
Course objectives:				
<ul style="list-style-type: none"> • To understand the fundamental concepts in graph theory. • To apply graph theory in different fields • To improve the different types of proof writing skills. • To learn to model problems using graphs • To solve the problems algorithmically. 				
Unit: I				18
The Incidence and Adjacency Matrices, Sub graphs, Vertex degrees, Paths and Connection, Cycles, Sperner's lemma, Trees, Cut edges and Bonds, Cut vertices				
Unit: II				18
Euler tours, Hamiltonian cycles, The travelling salesman problem, Matchings, Matchings and Coverings in Bipartite graphs				
Unit: III				18
Edge Chromatic Number, Vizing's Theorem, Chromatic number, Brook's theorem.				
Unit: IV				18
Plane and Planar graphs, Dual Graphs ,Euler's formula ,Bridges ,Kuratowski's Theorem, Directed Graphs, Directed Paths, Directed Cycles, Flows, Cuts, The Max-Flow Min –Cut theorem.				
Unit: V				18
Algorithms : connectedness and components – spanning tree – cut vertices and separability – directed circuits – shortest path algorithm – planarity testing – isomorphism				
Total Lecture Hours				90
Books for Study:				
1. J.A.Bondy and U.S.R.Murty, Graph Theory with Applications. North Holland Publications, New york, 1976.				
Unit I - Chapter 1 : Section 1.3 to 1.7 and 1.9				
Chapter 2: Section 2.1 to 2.3				
Unit II – Chapter 4: Section 4.1, 4.2 and 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 to 9.5				
Chapter 10 : Section 10.1 to 10.3				
2. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, 1979.				
Unit V - Chapter 11 : Section 11.4 to 11.7				

Books for References:

1. John Clark and Derek Allan Holton, **A first look at Graph Theory**, World Scientific Publications, Singapore, 1991.
2. Harary, **Graph Theory**, Narosa Publishing House, New Delhi, 1988.
3. S.K.Yadav, **Elements of Graph Theory**, Ane Books Pvt. Ltd, New Delhi, 2010

Web 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 Outcomes**K Level****On the 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.	K3
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	PO 7
CO 1	3	2	1	-	-	2	-
CO 2	2	2	2	1	2	1	1
CO 3	2	1	1	1	2	-	1
CO 4	3	2	1	1	1	1	2
CO 5	3	2	3	2	2	1	3

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

LESSON PLAN

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

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

Learning Outcome Based Education & Assessment (LOBE)								
Formative Examination - Blue Print								
Articulation Mapping – K Levels with Course Outcomes (COs)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	3
AI	CO2	Upto K3	2	K1&K2	2	K2	2	3
CI	CO3	Upto K4	2	K1&K2	1	K2	2	3
AII	CO4	Upto K4	2	K1&K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MOQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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		
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.								

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions			(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 (Either/Or Type)			
Answer All Questions			(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: Higher level of performance of the students is to be assessed by attempting higher level of K levels			
Section D (Open Choice)			
Answer Any Three questions			(3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K4	
24	CO4	K5	
25	CO5	K3	



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

Course Name	CLASSICAL MECHANICS				
Course Code	21PMTTC15	L	P	C	
Category	Core	6	-	4	
Nature of course:	EMPLOYABILITY	<input checked="" type="checkbox"/>	SKILL ORIENTED	ENTREPRENURSHIP	
Course objectives:					
<ul style="list-style-type: none"> ❖ To recall the basic concepts of motion of a particle. ❖ To understand D' Alembert's Principle and Lagrangian's Formulation. ❖ To derive the Lagrange's Equations from Hamilton's Principle. ❖ To apply the concept of the Equations of Motion and the Equivalent one-dimensional Problems. ❖ To understand the Kepler's law and Inverse-Square Law of Force. 					
Unit: I					18
Mechanics of a Particle, Mechanics of a System of Particles, Constraints.					
Unit: II					18
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.					
Unit: III					18
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.					
Unit: IV					18
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					
Unit: V					18
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.					
Total Lecture Hours					90
Books for Study:					
H.Goldstein, Classical Mechanics , Second Edition, Addison Wesley, Newyork, 1980.					
Unit I	-	Chapter 1 : Section 1.1 to 1.3			
Unit II	-	Chapter 1 : Section 1.4, 1.5 & Chapter 2 : Section 2.1, 2.2			
Unit III	-	Chapter 2 : Section 2.3 to 2.6			
Unit IV	-	Chapter 3 : Section 3.1 to 3.4			
Unit V	-	Chapter 3 : Section 3.5 to 3.9			

Books for References:

1. Madhumangal, A Course on Classical Mechanics, Narosa Publishing Private Ltd, New Delhi, 2009.
2. B.D.Gupta, Satya Prakash, Classical Mechanics, 6th Edition, Kedar Nath Ram Nath Publications, Meerut, 1987-1988
3. R.Douglas Gregory, Classical Mechanics, Cambridge University Press.

Web Resources

<http://staff.um.edu.mt/jmus1/diffeq1.pdf>
<https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/>
<http://math.huji.ac.il/~razk/Teaching/LectureNotes/LectureNotesMechanics.pdf>

COURSE OUTCOMES**K Level****On the successful completion of the course , the students will be able to**

CO1:	Demonstrate the understanding of the fundamental concepts in dynamics of system of particle.	K2
CO2:	Derive D'Alembert 's principle, Lagrange's equations and Hamilton's principle.	K4
CO3:	Represent the complicated mechanical systems using the Lagrangian and Hamiltonian principle.	K2
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 vector.	K4

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	2	2	1	1	2	-	1
CO 2	2	2	1	2	2	-	1
CO 3	2	2	1	2	1	-	1
CO 4	2	2	1	1	2	-	1
CO 5	2	2	1	1	2	-	1

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	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
III	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 – K Levels with Course Outcomes (COs)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CI AI	CO1	Upto K2	2	K1& K2	1	K1	2	3
	CO2	Upto K3	2	K1& K2	2	K2	2	3
CI AII	CO3	Upto K4	2	K1& K2	1	K2	2	3
	CO4	Upto K4	2	K1& K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MOQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions (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 (Either/Or Type)			
Answer All Questions (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	

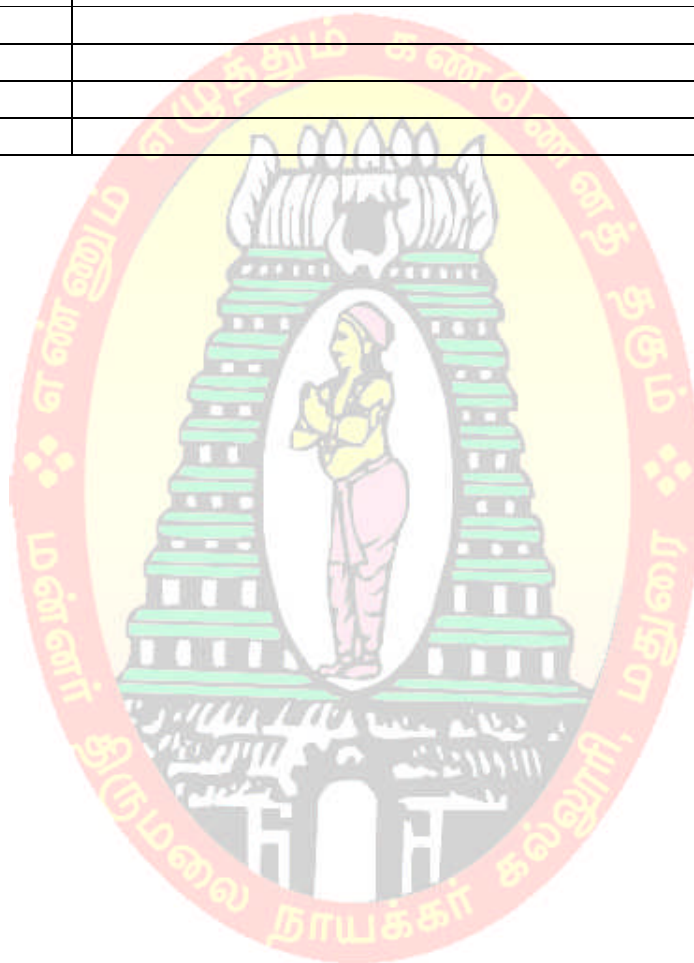
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels

Section D (Open Choice)

Answer Any Three questions

(3x10=30 marks)

Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K4	
23	CO3	K2	
24	CO4	K3	
25	CO5	K4	







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	P	C
Category	Core	6	-	4
Nature of course:	EMPLOYABILITY	<input checked="" type="checkbox"/> SKILL ORIENTED	ENTREPRENURSHIP	
Course objectives:				
<ul style="list-style-type: none"> • To familiarize various methods on solving algebraic equations. • To introduce Schwarz's inequality. • To explain about various transformations. • To study about determinants. • To explain canonical and triangular forms. 				
Unit: I				18
Elementary Basic Concepts - Dual Spaces – Inner Product Spaces.				
Unit: II				18
The Algebra of linear transformations, Characteristic roots				
Unit: III				18
Canonical forms, Triangular form, Nilpotent transformations				
Unit: IV				18
Trace and Transpose, Determinants.				
Unit: V				18
Hermitian, Unitary and Normal transformations				
Total Lecture Hours				90
Books for Study:				
I. N.Herstein, Topics in Algebra , Second Edition, John Wiley and Sons, New Delhi, Reprint 2010.				
Unit I - Chapter 4: Section 4.1, 4.3 ,4.4.				
Unit II - Chapter 6: Section 6.1 and 6.2				
Unit III - Chapter 6: Sections 6.4 and 6.5				
Unit IV - Chapter 6 : Section 6.8 and 6.9				
Unit V - Chapter 6: Section 6.10				
Books for References:				

1. Thomas W.Hungerford, **Algebra**, Springer International Edition, Newyork, 2009.
2. M.L. Khanna, **Linear Algebra**, Jai PrakashNath Publications, Meerut, 1984.
3. Martin Isaacs ,**Algebra**, Library of Congress Cataloging-in-Publication Data, Edition, New Delhi, 2009.

Web Resources

<https://nptel.ac.in/courses/111/106/111106131/>

<https://www.youtube.com/watch?v=yKRbG9Y5pYY&list=PLEAYkSg4uSQ3AaON5oCbS6ecwKsoopBN3>

<https://www.youtube.com/watch?v=cDCFS68W7ZA>

Course outcomes:**K Level****On the 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	PO 7
CO 1	3	2	2	2	2	2	1
CO 2	2	3	1	2	3	2	1
CO 3	3	2	-	1	-	1	-
CO 4	2	2	2	1	2	2	-
CO 5	3	2	2	2	1	2	1

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	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 with Course Outcomes (COs)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CO1	Upto K2	2	K1 & K2	1	K1	2	3
	CO2	Upto K3	2	K1 & K2	2	K2	2	3
CIA II	CO3	Upto K4	2	K1 & K2	1	K2	2	3
	CO4	Upto K4	2	K1 & K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MCQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions			(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 (Either/Or Type)			
Answer All Questions			(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	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)			
Answer Any Three questions			(3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K2	
24	CO4	K3	
25	CO5	K5	



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

Course Name	PARTIAL DIFFERENTIAL EQUATIONS			
Course Code	21PMTC22	L	P	C
Category	Core	6	-	4
Nature of course:	EMPLOYABILITY	✓ SKILL ORIENTED	ENTREPRENURSHIP	
Course objectives:				
<ul style="list-style-type: none"> • To study about linear classifications of partial differential equations. • To solve different types of PDEs using various methods. • To classify second order PDEs. • To derive one dimensional wave and heat conduction equations. • To solve Dirichlet's and Neumann's Problem in various domain. 				
Unit: I				18
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.				
Unit: II				18
Integral Surfaces Through a Given Curve –Quasi-Linear Equation –Non- Linear First Order P.D.E.				
Unit: III				18
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).				
Unit: IV				18
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.				
Unit: V				18
Green's function, Heat Conduction Problem – Heat Conduction –Infinite Rod Case- Heat Conduction Finite Rod Case – Duhamel's Principle – Wave Equation –Heat Conduction Equation				
Total Lecture Hours				90
Books for Study:				
T.Amarnath, An Elementary Course in Partial Differential Equation , Narosa Publishing Company, Chennai, 1997.				
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 2.3.3and 2.3.5)				
Unit IV - Chapter 2 : Section 2.4.1 to 2.4.10				
Unit V - Chapter 2 : Section 2.4 (2.4.11 to 2.4.13)				
Section 2.5 (2.5.1and 2.5.2)				
Section 2.6 (2.6.1and 2.6.2)				

Books for References:

1. E.T. Copson, **Partial differential equations**, S. Chand and Company Ltd., New Delhi, 1984.
2. Jeffrey Raich, **Partial differential equations**, Springer Publisher, Newyork, 1991.
3. Ian Sneddon, **Elements of Partial Differential Equations**, Mc Graw-Hill Book Company, New Delhi, 1985.

Web Resources

https://www.iist.ac.in/sites/default/files/people/IN08026/Canonical_form.pdf.
<https://nptel.ac.in/courses/111/107/111107111/>
<https://nptel.ac.in/courses/122/107/122107037/>

COURSE OUTCOMES**K Level****On the successful completion of the course , the students will be able to**

CO1:	Solve the Linear first order partial differential equations using various methods.	K3
CO2:	Analyze the Semi-linear, Quasi-linear & Non-linear first order partial differential equations.	K4
CO3:	Classify the second order partial differential equations	K4
CO4:	Apply the concepts of partial differential equations in solving boundary value problems.	K3
CO5:	Determine the solutions for homogeneous and non-homogeneous partial differential equations.	K3

CO & PO Mapping:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	1	1	3	1	1
CO 2	3	2	1	1	2	-	-
CO 3	3	2	1	-	2	1	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
I	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	18	Chalk & Talk

	Separation of Variables).		
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)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of. Questions	K - Level	No. of. Questions	K - Level		
CI AI	CO1	Upto K2	2	K1 & K2	1	K1	2	3
	CO2	Upto K3	2	K1 & K2	2	K2	2	3
CI AII	CO3	Upto K4	2	K1 & K2	1	K2	2	3
	CO4	Upto K4	2	K1 & K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MCQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions) Answer 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 (Short Answers) Answer All Questions (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 (Either/Or Type) Answer All Questions (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	

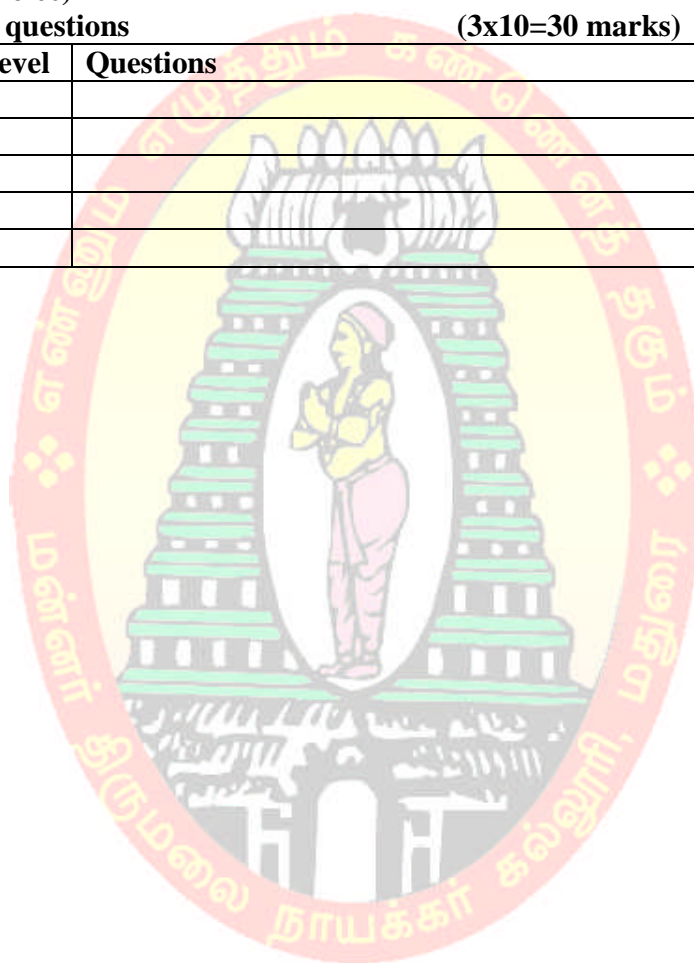
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels

Section D (Open Choice)

Answer Any Three questions

(3x10=30 marks)

Q.No	CO	K Level	Questions
21	CO1	K3	
22	CO2	K4	
23	CO3	K4	
24	CO4	K3	
25	CO5	K3	





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

Course Name	NUMERICAL ANALYSIS			
Course Code	21PMTTC23	L	P	C
Category	Core	6	-	4
Nature of course:	EMPLOYABILITY	✓ SKILL ORIENTED	ENTREPRENURSHIP	
Course Objectives:				
<ul style="list-style-type: none"> • To develop Numerical computational skills. • To practice Numerical computational applications. • To introduce difference equations and recurrence equations. • To demonstrate understanding and implementation of numerical solution of algorithms based for employability • To find the errors in the approximation 				
Unit: I				18
Bisection method – Iteration method (approximation method) based on first degree equation, second degree equation, General Iteration Methods .				
Unit: II				18
Direct methods: forward substitution method, back substitution method, Cramer rule, Gauss elimination method, Gauss Jordan method – triangulation method – LU decomposition– Cholesky method – Partition method.				
Unit: III				18
Iterative methods - Jacobi iteration methods, Gauss-Seidel iteration methods, Similarity transformation – Eigen values – Eigen vectors –Jacobi method for symmetric matrices.				
Unit: IV				18
Lagrange's and Newton Interpolation, Finite Difference Operators, Interpolating Polynomials using Finite Differences, Hermite Interpolation.				
Unit: V				18
Numerical Differentiation, Partial Differentiation, Numerical Integration, Methods based on Interpolation, Composite Integration methods.				
Total Lecture Hours				90
Books for Study:				
M.K.Jain, S.R.K.Iyengar, R.K.Jain, Numerical Methods for scientific and Engineering computation – 4th edition, New age international Pvt limited, New Delhi, 2009.				
Unit I - Chapter 2 : Section 2.1-2.4 and 2.6 Unit II - Chapter 3 : Section 3.1, 3.2 Unit III - Chapter 3 : Section 3.4, 3.5 and 3.7 Unit IV - Chapter 4 : Section 4.1 – 4.5 Unit V - Chapter 5 : Section 5.1, 5.2, 5.5 - 5.7, 5.9.				
Books for References:				
1. G.Shankar Rao, Numerical Analysis , New Age International publishers, New Delhi,1997.				

2. Rainer Kress, **Numerical Analysis**, Springer international Edition, New Delhi, 2010.
3. S.R.K.Iyengar ,R.K.Jain ,**Numerical Methods**, , New age international Pvt limited, New Delhi, 2008

Web Resources

<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 the successful completion of the course , the students will be able to**

CO1:	Demonstrate the understanding of direct methods and iterative methods for equations	K2
CO2:	Apply proper methods for solving transcendental, algebraic and system of 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	PO 7
CO 1	3	2	3	2	3	2	-
CO 2	3	2	3	2	2	2	1
CO 3	2	2	2	2	3	2	2
CO 4	2	3	2	-	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
II	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	18	Chalk &

	Integration, Methods based on Interpolation, Composite Integration methods.		Talk
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Course Designed by: **Dr.M.Saravanan** and **Dr.A.Arivuchelvam**

Learning Outcome Based Education & Assessment (LOBE)								
Formative Examination - Blue Print								
Articulation Mapping – K Levels with Course Outcomes (COs)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CI AI	CO1	Upto K2	2	K1 & K2	1	K1	2	3
	CO2	Upto K3	2	K1 & K2	2	K2	2	3
CI AII	CO3	Upto K4	2	K1 & K2	1	K2	2	3
	CO4	Upto K4	2	K1 & K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MCQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Questions	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions) Answer 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 (Short Answers) Answer All Questions (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 (Either/Or Type) Answer All Questions (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	K2	
19) b	CO4	K2	
20) a	CO5	K3	
20) b	CO5	K3	

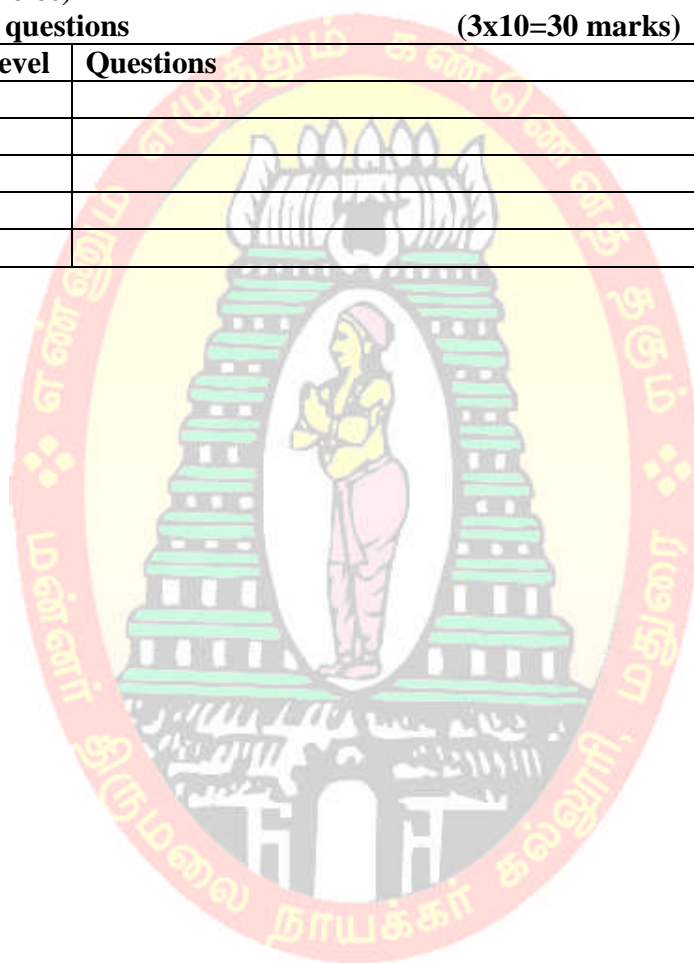
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels

Section D (Open Choice)

Answer Any Three questions

(3x10=30 marks)

Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K5	
24	CO4	K2	
25	CO5	K3	





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

Course Name	FUZZY ALGEBRA AND ITS APPLICATIONS			
Course Code	21PMTC24	L	P	C
Category	Core	6	-	4
Nature of course:	EMPLOYABILITY	✓	SKILL ORIENTED	ENTREPRENURSHIP
Course Objectives:				
<ul style="list-style-type: none"> • 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				18
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				
Unit: II				18
Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Arithmetic operation on fuzzy numbers				
Unit: III				18
Fuzzy relation : Crisp versus Fuzzy relation – projection and cylindric extensions- Binary fuzzy relation on a single set – fuzzy equivalence relations – Fuzzy compatibility relation				
Unit: IV				18
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				
Unit: V				18
Applications : Applications to Civil Engineering –Computer Engineering – Reliability theory – Robotics – Medicine – Economics.				
Total Lecture Hours				90
Books for Study:				
George J Klir and B.Yuan, Fuzzy sets and Fuzzy logic – Theory and application , Second 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:

1. H.J.Zimmermann, **Fuzzy Set Theory and its Applications**, Fourth Edition, Springer Publishers, New Delhi, 2006.
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.thesis scientist.com/docs/Study%20Notes/66860129-5a91-459d-810f-54e0fc41175d>
<https://ocw.mit.edu/courses/health-sciences-and-technology/hst-951j-medical-decision-support-spring-2003/lecture-notes/lecture4.pdf>
<https://www.iitk.ac.in/eeold/archive/courses/2013/intel-info/d1pdf3.pdf>
<https://nptel.ac.in/courses/106105173/2>
https://www.cse.iitb.ac.in/~cs621-2011/lectures_2009/cs621-lect38-fuzzy-logic-2009-11-11.ppt

COURSE OUTCOMES**K Level****On the 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	PO 7
CO 1	3	2	-	1	2	-	-
CO 2	2	2	-	-	2	-	-
CO 3	2	1	1	2	2	1	2
CO 4	2	1	1	2	2	1	2
CO 5	2	1	1	1	-	2	2

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	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 cylindric 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)

Formative Examination - Blue Print

Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of. Questions	K - Level	No. of. Questions	K - Level		
CI	CO1	Upto K2	2	K1&K2	1	K1	2	3
AI	CO2	Upto K3	2	K1&K2	2	K2	2	3
CI	CO3	Upto K4	2	K1&K2	1	K2	2	3
AII	CO4	Upto K4	2	K1&K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MCQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Questions	K – Level		
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 Asked			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 parenthesis denotes, questions should be asked with the given K level)

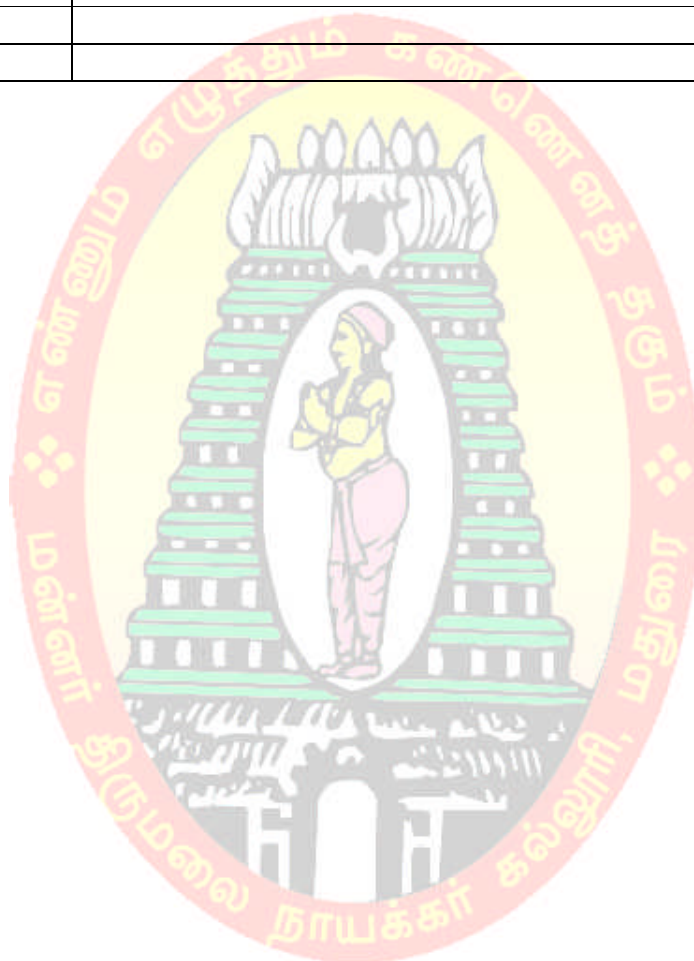
Distribution of Marks with K Level							
K Level	Section A (Multiple Choice Questions)	Section B (Short Answer Questions)	Section C (Either/ or Choice)	Section D (Open Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	4			9	7.5	17
K2	5	6			11	9.17	
K3			25	20	45	37.5	37
K4			25	30	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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions (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 (Either/Or Type)			
Answer All Questions (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: Higher level of performance of the students is to be assessed by attempting higher level of K levels			
Section D (Open Choice)			
Answer Any Three questions		(3x10=30 marks)	
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K2	
23	CO3	K5	
24	CO4	K3	
25	CO5	K3	





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

Course Name	MATHEMATICS FOR COMPETITIVE EXAMINATIONS				
Course Code	21PMTN21	L	P	C	
Category	Non Major Elective Course	6	-	6	
Nature of course:	EMPLOYABILITY	✓	SKILL ORIENTED	✓	ENTREPRENEURSHIP
Course objectives:					
<ul style="list-style-type: none"> • To develop knowledge on numbers, data interpretation. • To familiarize the application through various statistical methods. • To convert real data into a statistical data interpretation. • To use these concepts in competitive examinations. • To develop the computational skills. 					
Unit: I					18
H.C.F. and L.C.M. of numbers – Simplifications.					
Unit: II					18
Percentage – Profit and loss – Ratio and proportion.					
Unit: III					18
Time and work – Time and distance – Problems on Trains.					
Unit: IV					18
Simple interest – Compound interest – Permutation and Combination.					
Unit: V					18
Data interpretation: Tabulation – Bar Graphs – Pie charts.					
Total Lecture Hours					90
Books for Study:					
Aggarwal. R.S, Quantitative Aptitude , S.Chand and Company Ltd, 2009, New Delhi.					
Unit I – Chapters 2 & 4 (Except exercises)					
Unit II – Chapters 10, 11 & 12 (Except exercises)					
Unit III – Chapters 15, 17 & 18 (Except exercises)					
Unit IV – Chapters 21, 22 & 30 (Except exercises)					
Unit V – Chapters 36, 37 & 38 (Except exercises)					
Books for References:					
1. Abhigit Guha, Quantitative Aptitude , 4 th Edition, Tata McGraw Hill Publications, 2011, New Delhi.					
2. Mohan Rao.U, Quantitative Aptitude , Scitech Publications, Reprint 2013, Chennai.					
3. Aggarwal. R.S, Verbal & Non Verbal Reasoning , S.Chand & Co, 2009, New Delhi.					
Web Resources					
https://thecompanyboy.com/rs-aggarwal-quantitative-aptitude-pdf-free-download					
https://www.toprankers.com/exams/quantitative-aptitude-questions-pdf/					
https://www.sawaal.com/aptitude-reasoning/quantitative-aptitude-arithmetic-ability-questions-and-answers.html					

COURSE OUTCOMES		K Level
On the successful completion of the course , the students will be able to		
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	PO 7
CO 1	3	2	3	3	3	2	1
CO 2	3	2	3	3	3	3	1
CO 3	3	2	3	3	3	2	2
CO 4	3	3	2	3	3	2	1
CO 5	2	3	2	3	3	2	1

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

LESSON PLAN

UNIT	COURSE NAME	Hours	Pedagogy
I	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 Combination.	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 with Course Outcomes (COs)								
Internal	Cos	K Level	Section A		Section B		Section C Either or Choice	Section D Open Choice
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CO1	Upto K2	2	K1 & K2	1	K1	2	3
	CO2	Upto K3	2	K1 & K2	2	K2	2	3
CIA II	CO3	Upto K4	2	K1 & K2	1	K2	2	3
	CO4	Upto K4	2	K1 & K2	2	K2	2	3
Question Pattern CIA I & II	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		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 %
CIA I	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	100	100
CIA II	K1	2	2			4	6.67	17
	K2	2	4			6	10	
	K3			10	20	30	50	50
	K4			10	10	20	33.33	33
	Marks	4	6	20	30	60	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	COs	K - Level	MCQs		Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K – Level	No. of Question	K – Level		
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 Asked			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 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	
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.

Summative Examinations - Question Paper – Format

Section A (Multiple Choice Questions)			
Answer 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 (Short Answers)			
Answer All Questions			(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 (Either/Or Type)			
Answer All Questions			(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	K2	
20) b	CO5	K2	
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels			
Section D (Open Choice)			
Answer Any Three questions			(3x10=30 marks)
Q.No	CO	K Level	Questions
21	CO1	K2	
22	CO2	K3	
23	CO3	K5	
24	CO4	K4	
25	CO5	K2	