M.Sc., MATHEMATICS

Syllabus

Program Code: PMT

2024 - Onwards

MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with "A+" Grade by NAAC

PASUMALAI, MADURAI – 625 004

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS), MADURAI – 625 004

M. SC MATHEMATICS CURRICULUM

(For the students admitted from the academic year 2024-2025 onwards)

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
FIRST SEMESTER						
Part – III	**Core courses**					
24PMTCC11	Algebraic Structures	6	5	25	75	100
24PMTCC12	Real Analysis - I	6	5	25	75	100
24PMTCC13	Ordinary Differential Equations	6	4	25	75	100
Part – III	**Elective courses**					
24PMTEC11	Graph Theory and Applications	6	3	25	75	100
24PMTEC12	Fuzzy Sets and Their Applications	6	3	25	75	100
	Total	30	20	125	375	500
SECOND SEMESTER						
Part – III	**Core courses**					
24PMTCC21	Advanced Algebra	6	5	25	75	100
24PMTCC22	Real Analysis - II	6	5	25	75	100
24PMTCC23	Partial Differential Equations	6	4	25	75	100
Part – III	**Elective courses**					
24PMTEC21	Numerical Analysis	5	3	25	75	100
24PMTEC22	Resource Management Techniques	5	3	25	75	100
24PMTSP21	Mathematics Using Python	2	2	25	75	100
	Total	30	22	150	450	600

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
THIRD SEMESTER						
Part – III	**Core courses**					
24PMTCC31	Complex Analysis	6	5	25	75	100
24PMTCC32	Probability Theory	6	5	25	75	100
24PMTCC33	Topology	6	5	25	75	100
Part – III	**Elective course**					
24PMTEC31	Combinatorial Mathematics	4	3	25	75	100
Part - IV	**Skill Enhancement course**					
24PMTSP31	Mathematical Documentation Using Latex	2	2	25	75	100
Part - IV	**Non Major Elective course**					
24PMTNM31	Mathematics for Competitive Examinations	6	3	25	75	100
24PMTIN31	Internship Report	-	2	25	75	100
	Total	30	25	175	525	700
FOURTH SEMESTER						
Part – III	**Core courses**					
24PMTCC41	Functional Analysis	6	5	25	75	100
24PMTCC42	Integral Equations	6	5	25	75	100
24PMTPR41	Project with Viva-Voce	10	7	25	75	100
Part – III	**Elective course**					
24PMTEC41	Mathematics for SET/NET & General Studies for UPSC/TNPSC	4	3	25	75	100
Part – IV	**Skill Enhancement course**					
24PMTSP41	Numerical Analysis Using Python	4	2	25	75	100
Part - V	**Extension Activities**					
24PEXTG41	Extension Activity	-	1	25	75	100
	Total	30	23	150	450	600
	Grand Total	120	90	600	1800	2400


THIRD SEMESTER

Course Name	Complex Analysis			
Course Code	24PMTCC31	**L**	**P**	**C**
Category	Core	6	-	5

COURSE OBJECTIVES:

- To Study Cauchy integral formula, local properties of analytic functions, general form of Cauchy's theorem and evaluation of definite integral and harmonic functions

UNIT – I	**Cauchy's Integral Formula**	**18**

The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytical Functions:Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.

UNIT – II	**The general form of Cauchy's Theorem**	**18**

Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multiply connected regions - Residue theorem - The argument principle.

UNIT - III	**Evaluation of Definite Integrals and Harmonic Functions**	**18**

Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.

UNIT – IV	**Harmonic Functions and Power Series Expansions**	**18**

Schwarz theorem - The reflection principle - Weierstrass theorem – Taylor's Series – Laurent series

UNIT - V	**Partial Fractions and Entire Functions**	**18**

Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem

Total Lecture Hours	**90**

BOOKS FOR STUDY:

- Lars V. Ahlfors, *Complex Analysis*, (3rd edition) McGraw Hill Co., New York, 1979

UNIT-I : Chapter 4 : Section 2 : 2.1 to 2.3
Chapter 4 : Section 3 : 3.1 to 3.4
UNIT-II: Chapter 4 : Section 4 : 4.1 to 4.7
UNIT-III: Chapter 4 : Section 5: 5.1 and 5.2
Chapter 4 : Section 5 : 5.3
UNIT-IV : Chapter 4 : Sections 6 : 6.1 to 6.3
Chapter 4 : Sections 6.4 and 6.5
Chapter 5 : Sections 1.1 to 1.3
UNIT-V: Chapter 5 : Sections 2.1 to 2.4
Chapter 5 : Sections 3.1 and 3.2

BOOKS FOR REFERENCES:

- H.A. Presfly, *Introduction to complex Analysis*, Clarendon Press, oxford, 1990.
- J.B. Conway, *Functions of one complex variables* Springer - Verlag, International student Edition, Naroser Publishing Co.1978
- E. Hille, *Analytic function Thorey* (2 vols.), Gonm& Co, 1959.
- M.Heins, *Complex function Theory*, Academic Press, New York,1968

WEB RESOURCES:

- **http://ocw.mit.edu/ocwweb/Mathematics,**
- **http://mathforum.org,**
- **http://www.opensource.org,**
- **http://en.wikipedia.org**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL		
Changes Made in the Course	Percentage of Change		**20**	No Changes Made			New Course			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Analyze and evaluate local properties of analytical functions and definite integrals.	K1 to K5
CO2	Describe the concept of definite integral and harmonic functions.	K1 to K5
CO3	Demonstrate the concept of the general form of Cauchy's theorem	K1 to K5
CO4	Develop Taylor and Laurent series	K1 to K5
CO5	Explain the infinite products, canonical products and jensen's formula .	K1 to K5

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3				
CO2	2	1	3	1	3	3				
CO3	3	2	3	1	3	3				
CO4	1	2	3	2	3	3				
CO5	3	1	2	3	3	3				

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:

UNIT	Complex Analysis	HRS	PEDAGOGY
I	The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytical Functions: Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.	18	Chalk & Talk
II	Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multiply connected regions - Residue theorem - The argument principle.	18	Chalk & Talk

III	Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.	**18**	**Chalk & Talk, PPT**
IV	Schwarz theorem - The reflection principle - Weierstrass theorem – Taylor's Series – Laurent series .	**18**	**Chalk & Talk**
V	Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem	**18**	**Seminar**

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 Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	K5						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2			2	3.6	
	K3		10	16	26	46.4	46.4
	K4		10	16	26	46.4	46.4
	K5						
	Marks	4	20	32	56	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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**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

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Probability Theory			
Course Code	24PMTCC32	L	P	C
Category	Core	6	-	5

COURSE OBJECTIVES:

- To introduce axiomatic approach to probability theory, to study some statistical characteristics, discrete and continuous distribution functions and their properties, characteristic function and basic limit theorems of probability.

UNIT – I Random Events and Random Variables **18**

Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

UNIT – II Parameters of the Distribution **18**

Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

UNIT - III Characteristic functions **18**

Properties of characteristic functions – Characteristic functions and moments – semi invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.

UNIT – IV Some Probability distributions **18**

One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.

UNIT - V Limit Theorems **18**

Stochastic convergence – Bernaulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – de Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

Total Lecture Hours **90**

BOOKS FOR STUDY:

- M. Fisz, *Probability Theory and Mathematical Statistics,* John Wiley and Sons, New York, 1963

UNIT I : Chapter 1: Sections 1.1 to 1.7
Chapter 2 : Sections 2.1 to 2.9
UNIT II: Chapter 3 : Sections 3.1 to 3.8
UNIT-III : Chapter 4 : Sections 4.1 to 4.7
UNIT-IV : Chapter 5 : Section 5.1 to 5.10 (Omit Section 5.11)
UNIT-V: Chapter 6 : Sections 6.1 to 6.4, 6.6 to 6.9 , 6.11 and 6.12. (Omit Sections 6.5, 6.10,6.13 to 6.15)

BOOKS FOR REFERENCES:

- R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
- K.L.Chung, A course in Probability, Academic Press, New York, 1974
- R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996
- V.K.RohatgiAn Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).
- S.I.Resnick, A Probability Path, Birhauser, Berlin,1999.
- B.R.Bhat , Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999.

WEB RESOURCES:

- **http://ocw.mit.edu/ocwweb/Mathematics,**
- **http://www.opensource.org**
- **http://www.probability.net**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL				
Changes Made in the Course	Percentage of Change			No Changes Made			New Course		✓			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	To define Random Events, Random Variables, to describe Probability, to apply Bayes, to define Distribution Function, to find Joint Distribution function, to find Marginal Distribution and Conditional Distribution function, to solve functions on random variables.	**K1 to K5**
CO2	To define Expectation, Moments and Chebyshev Inequality, to solve Regression of the first and second types.	**K1 to K5**
CO3	To define Characteristic functions, to define distribution function, to find probability generating functions, to solve problems applying characteristic functions	**K1 to K5**
CO4	To define One point, two-point, Binomial distributions, to solve problems of Hypergeometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions, to solve problems on Cauchy and Laplace distributions	**K1 to K5**
CO5	To discuss Stochastic convergence, Bernaulli law of large numbers, to elaborate Convergence of sequence of distribution functions, to prove Levy-Cramer Theorems and de Moivre-Laplace Theorems, to explain Poisson, Chebyshev, Khintchine Weak law of large numbers, to explain and solve problems on Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3				
CO2	2	1	3	1	3	3				
CO3	3	2	3	1	3	3				
CO4	1	2	3	2	3	3				
CO5	3	1	2	3	3	3				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE	3	2	1		

OF COURSE CONTRIBUTION TO POS					

LESSON PLAN:

UNIT	Probability Theory	HRS	PEDAGOGY
I	Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.	18	Chalk & Talk
II	Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.	18	Chalk & Talk
III	Properties of characteristic functions – Characteristic functions and moments – semi0invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.	18	Chalk & Talk
IV	One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.	18	Chalk & Talk
V	Stochastic convergence – Bernaulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – de Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.	18	Chalk & Talk

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 Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**2**			**2**	**3.6**	**25**
	K2	**2**	**10**		**12**	**21.4**	
	K3		**10**	**16**	**26**	**46.4**	**46.4**
	K4			**16**	**16**	**28.6**	**28.6**
	K5						
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	**2**			**2**	**3.6**	**7.2**
	K2	**2**			**2**	**3.6**	
	K3		**10**	**16**	**26**	**46.4**	**46.4**
	K4		**10**	**16**	**26**	**46.4**	**46.4**
	K5						
	Marks	**4**	**20**	**32**	**56**	**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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5			5	3.6	4
K2	5	20		25	17.8	18
K3		30	32	62	44.3	44
K4			48	48	34.3	34
Marks	10	50	80	140	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

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Topology			
Course Code	24PMTCC33	**L**	**P**	**C**
Category	Core	6	-	5

COURSE OBJECTIVES:

- To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.

UNIT – I	**Topological spaces**	**18**

Topological spaces – Basis for a topology – The order topology – The product topology on X × Y – The subspace topology – Closed sets and limit points.

UNIT – II	**Continuous functions**	**18**

Continuous functions – the product topology – The metric topology.

UNIT - III	**Connectedness**	**18**

Connected spaces- connected subspaces of the Real line – Components and local connectedness.

UNIT – IV	**Compactness**	**18**

Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness

UNIT - V	**Countability and Separation Axiom**	**18**

Countability and Separation Axiom: The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohnmetrization Theorem – The Tietz extension theorem.

Total Lecture Hours	**90**

BOOKS FOR STUDY:

- James R. Munkres, *Topology* (2nd Edition) Pearson Education Pve. Ltd., Delhi-2002 (Third Indian Reprint)

  Unit I - Chapter 2 : Sections 12 to 17
  Unit II - Chapter 2 : Sections 18 to 21 (Omit Section 22)
  Unit III - Chapter 3 : Sections 23 to 25.
  Unit IV - Chapter 3 : Sections 26 to 29.
  Unit V - Chapter 4 : Sections 30 to 35.

BOOKS FOR REFERENCES:

- J. Dugundji ,*Topology* , Prentice Hall of India, New Delhi, 1975.
- George F.Sinmons, *Introduction to Topology and Modern Analysis*, McGraw Hill Book Co., 1963
- J.L. Kelly, *General Topology*, Van Nostrand, Reinhold Co., New York
- L.Steen and J.Subhash, Counter Examples in Topology, Holt, Rinehart and Winston, New York, 1970.
- S.Willard, *General Topology*, Addison - Wesley, Mass., 1970.

WEB RESOURCES:

- **http://mathforum.org,**
- **http://ocw.mit.edu/ocwweb/Mathematics**
- **http://www.opensource.org,**
- **http://en.wikipedia.org**

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made	✓	New Course			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space.	K1 to K5
CO2	Understand continuity, compactness, connectedness, homeomorphism and topological properties.	K1 to K5
CO3	Analyze and apply the topological concepts in Functional Analysis.	K1 to K5
CO4	Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a topological space.	K1 to K5
CO5	Develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent(homeomorphic).	K1 to K5

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3				
CO2	2	1	3	1	3	3				
CO3	3	2	3	1	3	3				
CO4	1	2	3	2	3	3				
CO5	3	1	2	3	3	3				

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:

UNIT	Topology	HRS	PEDAGOGY
I	Topological spaces – Basis for a topology – The order topology – The product topology on X × Y – The subspace topology – Closed sets and limit points	18	Chalk & Talk

II	Continuous functions – the product topology – The metric topology.	**18**	**Chalk & Talk**
III	Connected spaces- connected subspaces of the Real line – Components and local connectedness.	**18**	**Chalk & Talk**
IV	Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness**.**	**18**	**Chalk & Talk**
V	The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohnmetrization Theorem – The Tietz extension theorem.	**18**	**Chalk & Talk**

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 Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	K5						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2			2	3.6	
	K3		10	16	26	46.4	46.4
	K4		10	16	26	46.4	46.4
	K5						
	Marks	4	20	32	56	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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**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

Q. No.	**Unit**	**CO**	**K-level**		
Answer **ALL** the questions			**PART – A**	**(10 x 1 = 10 Marks)**	
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Combinatorial Mathematics			
Course Code	24PMTEC31	**L**	**P**	**C**
Category	Elective	4	-	3

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 **12**

The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects.

UNIT – II **12**

Generating Functions for Combinations - Enumerators for Permutations – Distributions of Distinct Objects into Non distinct Cells - Partitions of Integers.

UNIT - III **12**

Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions

UNIT – IV **12**

The Principle of Inclusion and Exclusion - The General Formula - Derangements - Permutations with Restrictions on Relative Positions.

UNIT - V **12**

Equivalence Classes under a Permutation Group - Equivalence Classes of Functions -Weights and Inventories of Functions - Polya's Fundamental Theorem.

Total Lecture Hours **60**

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

Unit III: - Chapter 3: Sections 3.1 to 3.3

Unit IV: - Chapter 4: Sections 4.1 to 4.5

Unit V: - Chapter 5: Sections 5.1 to 5.6 (Except 5.2)

BOOKS FOR REFERENCES:

- J. H. Van Lint and R. M. Wilson, **A Course in Combinatorics**, Cambridge University Press, 2001.
- TituAndreescu and ZumingFeng, **A Path to Combinatorics**, Springer Science & Business Media, 2004.
- Douglas West, **Combinatorial Mathematics**, Cambridge University Press, 2020

WEB RESOURCES:

- **https://www.isinj.com/mt-usamo/Applied%20Combinatorics%20(6th%20Edition)%20by%20Alan%20Tucker%20Wiley%20(2012).pdf**
- **http://cseweb.ucsd.edu/~gill/AlgCombSite/Resources/CCSRefP1.pdf**
- **https://en.wikipedia.org/w/index.php?title=Special:WhatLinksHere&target=Algorithm**

Nature of Course	EMPLOYABILITY			SKILL ORIENTED		✓	ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		✓	NATIONAL			GLOBAL			
Changes Made in the Course	Percentage of Change			No Changes Made		✓	New Course					

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		K LEVEL
After studying this course, the students will be able to:		
CO1	Understand the rules of Sum and Product of Permutations and Combinations.	K1 to K5
CO2	Discuss distributions of Distinct Objects into Non-distinct Cells and Partitions of Integers.	K1 to K5
CO3	Identify Solutions by the technique of Generating Functions and Recurrence Relations with Two Indices.	K1 to K5
CO4	Make use of the concepts of Permutations with Restrictions on Relative Positions and the Rook Polynomials.	K1 to K5
CO5	Analyze equivanlence classes of functions in Polya's Theory	K1 to K5

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	1	1	1				
CO2	3	3	2	2	1	-				
CO3	3	3	3	1	1	1				
CO4	3	3	2	2	1	-				
CO5	3	3	2	2	2	1				

S- STRONG M – MEDIUM L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:

UNIT	Combinatorial Mathematics	HRS	PEDAGOGY
I	Permutations and Combinations Introduction - The rules of Sum and Product - Permutations - Combinations - Distributions of Distinct Objects - Distributions of Non distinct Objects	12	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	12	Chalk & Talk

III	Recurrence Relation Introduction - Linear Recurrence relations with Constant Coefficients - Solution by the technique of Generating Functions - Recurrence Relations with Two Indices	**12**	**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	**12**	**Chalk & Talk**
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	**12**	**Chalk & Talk**

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 Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	K5						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2			2	3.6	
	K3		10	16	26	46.4	46.4
	K4		10	16	26	46.4	46.4
	K5						
	Marks	4	20	32	56	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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**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

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Mathematical Documentation Using Latex			
Course Code	24PMTSP31	**L**	**P**	**C**
Category	Skill	-	2	2

COURSE OBJECTIVES:

- To introduce students with a software that is used for typesetting especially in Mathematics and develop typing skill for students with various documents formats of LaTeX.

List of Programmes

1. Creation of a document with different alignments
2. Typing a Letter for applying a job.
3. Creation of own Bio – Data.
4. Creating a Table Structure.
5. Typing a Mathematical Expression involving Differentiation, Integration and Trigonometry.
6. Typing a Mathematical Expression using all Expressions and Inequalities.
7. Creation of an Article using Latex.
8. Inserting Picture in a Latex.
9. Preparing a question paper in Latex Format.
10. Creation of Powerpoint Presentation in Latex.

Total Lecture Hours	**30**

BOOKS FOR REFERENCES:

- David F Griffiths and Desmond J. Higham, Learning LaTex, SIAM Publishers, Phildelphia, 1996
- A document preparation system LATEX, Second Edition, Leslie Lamport
- LATEX- A Beginner Guide to Professional documentation,S. Swapna Kumar.

WEB RESOURCES:

- **https://services.math.duke.edu/computing/tex/online.html,**
- **https://www.overleaf.com/learn**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**								

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Know how to create basic types of LaTex documents (article).	**K1 to K5**
CO2	typeset latex commands	**K1 to K5**
CO3	create a paragraph, symbols, comments and font style.	**K1 to K5**
CO4	change font characteristics.	**K1 to K5**
CO5	know about various environments	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	1	1	2				
CO2	3	2	1	1	1	2				
CO3	3	2	1	1	1	1				
CO4	3	1	1	1	1	1				
CO5	3	2	1	1	1	2				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	3	2		
CO 3	3	2	2		
CO 4	3	2	1		
CO 5	3	2	2		
WEIGHTAGE	15	11	8		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:		
List of Programmes	**HRS**	**PEDAGOGY**
1. Creation of a document with different alignments 2. Typing a Letter for applying a job. 3. Creation of own Bio – Data. 4. Creating a Table Structure. 5. Typing a Mathematical Expression involving Differentiation, Integration and Trigonometry. 6. Typing a Mathematical Expression using all Expressions and Inequalities. 7. Creation of an Article using Latex. 8. Inserting Picture in a Latex. 9. Preparing a question paper in Latex Format. 10. Creation of Powerpoint Presentation in Latex.	30	

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)							
Internal	**Cos**	**K Level**	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding & Implementation**	**Debugging & Outpu**
CIA	**CO1**	**K1**	**5**				
	CO2	**K2**		**5**			
	CO3	**K3**			**5**		
	CO4	**K4**				**5**	
	CO5	**K4**					**5**
Question Pattern CIA		**No. of Questions to be asked**	**2**	**2**	**2**	**2**	**2**
		No. of Questions to be answered	**2**	**2**	**2**	**2**	**2**
		Marks for each question	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
		Total Marks for each section	**5**	**5**	**5**	**5**	**5**

Distribution of Marks with K Level CIA									
	K Level	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding**	**Debugging & Output**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
CIA	**K1**	5					**5**	**20**	**20**
	K2		5				**5**	**20**	**20**
	K3			5			5	20	20
	K4				5	5	10	40	40
	Marks						**25**	**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**	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding& Implementation**	**Debugging & Output**
1	**CO1**	**K1**	**15**				
2	**CO2**	**K2**		**15**			
3	**CO3**	**K3**			**15**		
4	**CO4**	**K4**				**15**	
5	**CO5**	**K4**					**15**
No. of Questions to be Asked			**2**	**2**	**2**	**2**	**2**
No. of Questions to be answered			**2**	**2**	**2**	**2**	**2**
Marks for each question			**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Total Marks for each section			**15**	**15**	**15**	**15**	**15**
(Figures in parenthesis denotes, questions should be asked with the given K level)							

Distribution of Marks with K Level CIA									
	K Level	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding**	**Debugging & Output**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
CIA	**K1**	15					**15**	**20**	**20**
	K2		15				**15**	**20**	**20**
	K3			15			15	20	20
	K4				15	1 5	30	40	40
	Marks						**75**	**100**	**100**

Course Name	Mathematics for Competitive Examinations			
Course Code	24PMTNM31	**L**	**P**	**C**
Category	Non Major Elective	6	-	3

COURSE OBJECTIVES:

- 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**
Ratio and proportion	
UNIT – II	**18**
Simple Interest – Compound Interest	
UNIT - III	**18**
Proportions – Connectives – Conditional & Biconditional Proportions – Tautology and Contradiction	
UNIT – IV	**18**
Equivalence of Proportions – Duality – Tautological Implications – Truth Table Techniques	
UNIT - V	**18**
Non Verbal Reasoning and Number Series	
Total Lecture Hours	**90**

BOOKS FOR STUDY:

- Book Material will be provided by the department

BOOKS FOR REFERENCES:

- R.S Agarwal, **Quantitative Aptitude**, 4th Edition, Tata McGraw Hill Publications, 2011, New Delhi.
- T Veerarajan, **Discrete Mathematics**, Mcgraw Hill Publication.

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**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL		
Changes Made in the Course	Percentage of Change			No Changes Made			New Course		✓	

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Understand the concepts of Mathematics along with analytical ability	**K1 to K5**
CO2	Develop the mathematical problem solving skill	**K1 to K5**
CO3	Evaluate the problems on data interpretation	**K1 to K5**
CO4	Identify the time related problems and solving	**K1 to K5**
CO5	Illustrate appropriate methods for solving Permutation and Combination	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	3	3	2				
CO2	3	2	3	3	3	3				
CO3	3	2	3	3	3	2				
CO4	3	3	2	3	3	2				
CO5	2	3	2	3	3	2				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:			
UNIT	**Mathematics for Competitive Examinations**	**HRS**	**PEDAGOGY**
I	Ratio and proportion.	**18**	**PPT, Chalk & Talk, quiz**
II	Simple Interest – Compound Interest	**18**	**Chalk & Talk, PPT**
III	Proportions – Connectives – Conditional & Biconditional Proportions – Tautology and Contradiction	**18**	**Chalk & Talk**
IV	Equivalence of Proportions – Duality – Tautological Implications – Truth Table Techniques	**18**	**Chalk & Talk, Assignment**
V	Non Verbal Reasoning and Number Series	**18**	**Chalk & Talk, PPT**

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 Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	K5						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2			2	3.6	
	K3		10	16	26	46.4	46.4
	K4		10	16	26	46.4	46.4
	K5						
	Marks	4	20	32	56	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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**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

Q. No.	**Unit**	**CO**	**K-level**		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Internship Report			
Course Code	24PMTIN31	**L**	**P**	**C**
Category	Summer Internship	-	-	1

Course Description

The students have to attend a 30 hours of Internship of their own choice to be carried out in I year summer vacation.

Guidelines For Internship:

1. The Project is conducted by the following Course Pattern. The internship period should be minimum 30 hours.
2. Each group should produce permission letter as well as the attendance certificate.
3. There will be one Faculty guide.
4. The students should submit an Internship Training Report (Maximum 30 Pages).
5. The Marks for Internship Training will be awarded only on the basis of the Internship Training Report.
6. Prior permission may be obtained from the organization in advance by the students concerned and information shall be passed onto the colleges thus enabling the training supervision by the concerned faculties authorized by the college.
7. Daily postal or electronic reporting should be obtained to ensure coherent and comprehensive training during the training period.
8. A final report [Institutional Training Record – ITR] containing the introduction of the industry, the profile of the company and a valid conclusion indicating the benefits of the training shall be given not exceeding 30 [A4] pages [in a spiral- bound form/pre-printed record designed for this purpose]

Internal

Presentation Submission	**25**

External

Project Report Viva Voce	**75**
Total	**- 100**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		✓	NATIONAL			GLOBAL			
Changes Made in the Course	Percentage of Change			No Changes Made			New Course			✓		
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**												

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Explain the student to the environment and expectations of performance on the part of private/public companies or government entities	**K1 to K5**
CO2	Able to develop work habits and attitudes necessary for job success. Build a record of work experience	**K1 to K5**
CO3	Explore career alternatives by Integrating theory and practice and learn to appreciate work and its function in the economy.	**K1 to K5**
CO4	Expose the student to professional role models by developing communication, interpersonal and other critical skills	**K1 to K5**
CO5	Examine employer-valued skills such as teamwork, communications and attention to detail.	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	3	1	3				
CO2	1	2	2	1	2	1				
CO3	2	2	3	3	2	1				
CO4	3	2	3	2	1	2				
CO5	3	3	3	3	3	3				

3- STRONG **2 – MEDIUM** **1 - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		


FOURTH SEMESTER

Course Name	Functional Analysis			
Course Code	24PMTCC41	**L**	**P**	**C**
Category	Core	6	-	5

COURSE OBJECTIVES:

- To provide students with a strong foundation in functional analysis, focusing on spaces, operators and fundamental theorems. To develop student's skills and confidence in mathematical analysis and proof techniques.

UNIT – I Banach Spaces **18**

The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N^{**}- The open mapping theorem – The conjugate of an Operator.

UNIT – II Hilbert Spaces **18**

The definition and some simple properties–Orthogonal complements–Ortho normal sets–The conjugate space H^*-The adjoint of an operator–self-adjoint operators-Normal and unitary operators – Projections.

UNIT - III Finite-Dimensional Spectral Theory **18**

Matrices – Determinants and the spectrum of an operator –The spectral theorem.

UNIT – IV General Preliminaries on Banach Algebras **18**

The definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius– The radical and semi-simplicity

UNIT - V The Structure of Commutative Banach Algebras **18**

The Gelfand mapping – Application of the formular$(x) = \lim \|x^n\|^{1/n}$– Involutions in Banach algebras-The Gelfand-Neumark theorem

Total Lecture Hours **90**

BOOKS FOR STUDY:

- G.F.Simmons, **Introduction to Topology and Modern Analysis**, McGraw Hill Education (India) Private Limited, New Delhi, 1963

UNIT I: Chapter 9:Sections 46-51
UNIT II: Chapter10:Sections52-59
UNIT III: Chapter 11:Sections 60-62
UNIT IV: Chapter 12:Sections 64-69
UNIT V: Chapter 13:Sections 70-73

BOOKS FOR REFERENCES:

- W.Rudin, Functional Analysis, McGraw Hill Education (India) Private Limited, New Delhi, 1973.
- B.V. Limaye, Functional Analysis, New Age International,1996.
- C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.
- E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.
- M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, New Delhi, 2002

WEB RESOURCES:

- **http://mathforum.org**
- **http://ocw.mit.edu/ocwweb/Mathematics,**
- **http://www.opensource.org,**
- **http://en.wikiepedia.org**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP					
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL				
Changes Made in the Course	Percentage of Change			No Changes Made			New Course		✓			
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**												

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Understand the Banach spaces and Transformations on Banach Spaces.	**K1 to K5**
CO2	Prove Hahn Banach theorem and open mapping theorem.	**K1 to K5**
CO3	Describe operators and fundamental theorems	**K1 to K5**
CO4	Validate orthogonal and orthonormal sets.	**K1 to K5**
CO5	Analyze and establish the regular and singular elements.	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3				
CO2	2	1	3	1	3	3				
CO3	3	2	3	1	3	3				
CO4	1	2	3	2	3	3				
CO5	3	1	2	3	3	3				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:			
UNIT	**Functional Analysis**	**HRS**	**PEDAGOGY**
I	The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N^{**}- The open mapping theorem – The conjugate of an Operator.	**18**	**PPT, Chalk & Talk, quiz**
II	The definition and some simple properties–Orthogonal complements–Ortho normal sets–The conjugate space H*-The adjoint of an operator–self-adjoint operators-Normal and unitary operators – Projections.	**18**	**Chalk & Talk, PPT**
III	Finite-Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator –The spectral theorem.	**18**	**Chalk & Talk**
IV	The definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius– The radical and semi-simplicity.	**18**	**Chalk & Talk, Assignment**
V	The Structure of Commutative Banach Algebras: The Gelfand mapping – Application of the formular$(x) = \lim \|x^n\|^{1/n}$– Involutions in Banach algebras-The Gelfand-Neumark theorem.	**18**	**Chalk & Talk, PPT**

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 Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	K5						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2			2	3.6	
	K3		10	16	26	46.4	46.4
	K4		10	16	26	46.4	46.4
	K5						
	Marks	4	20	32	56	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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**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

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Integral Equations			
Course Code	24PMTCC42	**L**	**P**	**C**
Category	Core	6	-	5

COURSE OBJECTIVES:

- To familiarize the key concept of popular and useful transformations
- To understand the relationship between integral and differential equations.
- To familiarize Fredholm theory
- To apply integral equation in various transformations.

UNIT – I **18**

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

UNIT – II **18**

Integral transformation methods – introduction – Fourier transform – Laplace transform – application to Volterra integral equations with Convolution type kernels – examples.

UNIT - III **18**

Relationship between linear differential equations and Volterra integral equations, resolvent kernel of Volterra integral equations, solution of integral equation by resolvent kernel, the method of successive approximations

UNIT – IV **18**

Volterra integral equations with limits (x, $+\infty$), Volterra integral equations of the first kind, Euler integrals, Abel's problem, Abel's Integral equations and its generalisations.

UNIT - V **18**

Fredholm equations of the second kind, fundamentals, the method of Fredholm determinants, iterated kernals, constructing the resolvent kernel with the aid of iterated kernals

Total Lecture Hours **90**

BOOKS FOR STUDY:

Linear Integral Equations: Theory & Technique (Second Ed.) by Ram P. Kanwal, Springer Science& Business Media, 2013.
Unit 1: Chapter 1 full, chapter 2.1 to 2.5
Unit 2: Chapter 9.1 to 9.5.

Problems and exercises in Integral Equations by George Yankovsky , MIR Publishers.

Unit 3: Chapter 1 (2,3,4)
Unit 4: Chapter 1 (7,8,9,10)
Unit 5: Chapter 2 (12,13,14,15)

BOOKS FOR REFERENCES:

- "**Differential Equations**" by G.F. Simmons, Tata McGraw-Hill, New Delhi, 1979.
- "**Ordinary Differential Equations and Stability Theory"** by D.A. Sanchez, Dover, New York, 1968.
- "**Notes on Nonlinear Systems**" by J.K. Aggarwal, Van Nostrand, 1972.

WEB RESOURCES:

- **http://mathforum.org,**
- **http://ocw.mit.edu/oc**
- **www.web/Mathematics,**
- **www.physicsforum.com**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL		
Changes Made in the Course	Percentage of Change		**60**	No Changes Made			New Course			

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Explain various types of kernels	**K1 to K5**
CO2	Determine a wide range of differential and integral equations by Fourier transforms	**K1 to K5**
CO3	Solve linear Volterra integral equations using appropriate methods	**K1 to K5**
CO4	Solve Euler equations and Abel's problem	**K1 to K5**
CO5	Solve linear Fredholm integral equations using appropriate methods	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3				
CO2	2	1	3	1	3	3				

CO3	3	2	3	1	3	3				
CO4	1	2	3	2	3	3				
CO5	3	1	2	3	3	3				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:

UNIT	INTEGRAL EQUATIONS	HRS	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	PPT, Chalk & Talk, quiz
II	Integral transformation methods – introduction – Fourier transform – Laplace transform – application to Volterra integral equations with Convolution type kernels – examples.	18	Chalk & Talk, PPT
III	Relationship between linear differential equations and Volterra integral equations, resolvent kernel of Volterra integral equations, solution of integral equation by resolvent kernel, the method of successive approximations	18	Chalk & Talk
IV	Volterra integral equations with limits (x, $+\infty$), Volterra integral equations of the first kind, Euler integrals, Abel's problem, Abel's Integral equations and its generalisations.	18	Chalk & Talk, Assignment
V	Fredholm equations of the second kind, fundamentals, the method of Fredholm determinants, iterated kernals, constructing the resolvent kernel with the aid of iterated kernals	18	Chalk & Talk, PPT

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 Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	**Section A (Multiple Choice Questions)**	**Section B (Either / Or Choice)**	**Section C (Either / Or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA I	**K1**	**2**			**2**	**3.6**	**25**
	K2	**2**	**10**		**12**	**21.4**	
	K3		**10**	**16**	**26**	**46.4**	**46.4**
	K4			**16**	**16**	**28.6**	**28.6**
	K5						
	Marks	**4**	**20**	**32**	**56**	**100**	**100**
CIA II	**K1**	**2**			**2**	**3.6**	**7.2**
	K2	**2**			**2**	**3.6**	
	K3		**10**	**16**	**26**	**46.4**	**46.4**
	K4		**10**	**16**	**26**	**46.4**	**46.4**
	K5						
	Marks	**4**	**20**	**32**	**56**	**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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5			5	3.6	4
K2	5	20		25	17.8	18
K3		30	32	62	44.3	44
K4			48	48	34.3	34
Marks	10	50	80	140	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

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Project with Viva - Voce			
Course Code	24PMTPR41	**L**	**P**	**C**
Category	Project	10	-	7

COURSE OBJECTIVES:

- To apply and adapt a variety of problem – solving strategies to solve problems
- To improve thinking skills
- To promote effective mathematical communication.
- To provide learning environment that simulates and enhances effective learning
- To develop positive attitude towards mathematics

Course Description

The Project is conducted by the following Course Pattern.

Guidelines For Internship:

9. There will be one Faculty guide.
10. The students should submit a Project Report (Maximum 30 Pages).
11. The Marks for Project Report will be awarded only on the basis of the Project Report with Viva - Voce.

Internal

Presentation Submission	**25**

External

Project Report Viva Voce	**75**
Total	**- 100**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL	✓	NATIONAL		GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made	✓	New Course			
*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**								

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Apply the skill of presentation and communication techniques	**K1 to K5**
CO2	Motive as an individual or in a team in development of projects.	**K1 to K5**
CO3	Analyze the available resources and to select most appropriate one	**K1 to K5**
CO4	Make use of the fundamentals of Mathematics to search the related literature survey	**K1 to K5**
CO5	Evaluate the real life problems by using Mathematics and its Application.	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	3	1	3				
CO2	1	2	2	1	2	1				
CO3	2	2	3	3	2	1				
CO4	3	2	3	2	1	2				
CO5	3	3	3	3	3	3				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

Distribution of Marks with COs &K Level for Correction of CIA					
	COs	**K - Level**	**Distribution of the work of the experiment**	**K - Level**	**MARKS**
CIA	**CO1**	**K1 to K5**	Preliminary Research Problem - Introduction	**K1**	**4.0**
	CO2	**K1 to K5**	Literature Survey	**K2**	**5.0**
	CO3	**K1 to K5**	Understanding and Observation of the Data	**K3**	**8.0**
	CO4	**K1 to K5**	Results and Discussion	**K4**	**4.0**
	CO5	**K1 to K5**	Interpretation of result and Conclusion	**K5**	**4.0**
	Total Marks				**25**

Distribution of Marks with K Level CIA					
	K Level	**Distribution of the work of the experiment**	**Total Marks**	**% of (Marks without choice)**	**Consolidate of %**
CIA	K1	Preliminary Research Problem - Introduction	4	16.0	**-**
	K2	Literature Survey	5	20.0	
	K3	Understanding and Observation of the Data	8	32.0	**36.0**
	K4	Results and Discussion	4	16.0	**68.0**
	K5	Interpretation of result and Conclusion	4	16.0	**84.0**
	Marks		**25**	**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

K5 – Evaluating, interpreting and concluding the results with accurate measurements**.**

Distribution of Marks with COs &K Level for Correction of the Summative Exam				
COs	**K - Level**	**Distribution of the work of the experiment**	**K - Level**	**MARKS**
CO1	**K1 to K5**	Preliminary Research Problem - Introduction	**K1**	**10**
CO2	**K1 to K5**	Literature Survey and scope of the problem	**K2**	**10**
CO3	**K1 to K5**	Understanding and Observation of the Data	**K3**	**20**
CO4	**K1 to K5**	Results and Discussion	**K4**	**15**
CO5	**K1 to K5**	Viva Voce	**K5**	**20**
Total Marks				**75**

Distribution of Marks with K Level				
K Level	**Parameters for K-Level**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	Preliminary Research Problem - Introduction	**10**	**13.33**	**13.3**
K2	Literature Survey	**10**	**13.33**	**13.3**
K3	Understanding and Observation of the Data	**20**	**26.67**	**26.7**
K4	Results and Discussion	**15**	**20.0**	**20**
K5	Viva Voce	**20**	**26.67**	**26.7**
Marks		**75**	**100**	**100**

Course Name	Mathematics for SET/ NET & General Studies for UPSC/ TNPSC			
Course Code	24PMTEC41	**L**	**P**	**C**
Category	Elective	4	-	3

COURSE OBJECTIVES:

- The course provides various mathematical aptitude techniques of solving problems

UNIT – I Algebra	**12**
Groups–Sub Groups-Quotients groups –Homomorphisms-Cyclic groups-Permutations-Combinations-Matrices-Rank and Determinant of matrices-Linear equations-Eigen values and Eigen vectors.	
UNIT – II Analysis	**12**
Elementary set theory-Countable and Uncountable sets-Sequences and Series-Convergence-Continuity and Differentiability-Uniform Convergence-Algebra of complex Numbers: Polynomials-Power Series-Analytic functions-Cauchy Riemann Equations-Calculus of Residues-Singular points.	
UNIT - III Differential Equations	**12**
Existence and Uniqueness of solutions of IVP-General Theory of Homogeneous and non-homogeneous linear ODE's-Lagrange and Charpit Methods for solving first order PDE's-Method of Separation of variables for Laplace, Heat and Wave Equations.	
UNIT – IV	**12**
Percentage – profit and loss - proportion	
UNIT - V	**12**
Simple Interest and Compound interest, Time and work	
Total Lecture Hours	**60**

BOOKS FOR STUDY:

- Material will be provided by the department

BOOKS FOR REFERENCES:

- Upkar's CSIR-UGC NET/JRF/SET Mathematical Science by Dr. Alok Kumar.
- Agarwal R.S, Publishers: S.Chand and Co " Quantitative Aptitude" 1990

WEB RESOURCES:

- **https://www.classcentral.com/course/swayam-operations-research-14219**
- **https://developers.google.com/optimization/support/resources**

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Understand the basic concepts of Algebra and linear Algebra.	**K1 to K5**
CO2	Enhance their ability in Real and Complex Analysis	**K1 to K5**
CO3	Utilize the knowledge to solve the problems in Differential Equations.	**K1 to K5**
CO4	Apply for competitive examinations with more confidence	**K1 to K5**
CO5	Solve mathematical problems within a limited time frame.	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	1	1	2	2				
CO2	1	2	3	2	3	1				
CO3	3	2	2	1	3	1				
CO4	1	2	2	3	2	2				
CO5	3	1	2	2	3	1				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

LESSON PLAN:			
UNIT	**Mathematics for SET/ NET & General Studies for UPSC/ TNPSC**	**HRS**	**PEDAGOGY**
I	Groups–Sub Groups-Quotients groups –Homomorphisms-Cyclic groups-Permutations-Combinations-Matrices-Rank and Determinant of matrices-Linear equations-Eigen values and Eigen vectors.	**12**	**Chalk and Board, Virtual Class room, LCD projector**
II	Elementary set theory-Countable and Uncountable sets-Sequences and Series-Convergence-Continuity and Differentiability-Uniform Convergence-Algebra of complex Numbers: Polynomials-Power Series-Analytic functions-Cauchy Riemann Equations-Calculus of Residues-Singular points.	**12**	**Guest Lectures.**
III	Existence and Uniqueness of solutions of IVP-General Theory of Homogeneous and non-homogeneous linear ODE's-Lagrange and Charpit Methods for solving first order PDE's-Method of Separation of variables for Laplace, Heat and Wave Equations.	**12**	**Chalk & Talk**
IV	Percentage – profit and loss - proportion	**12**	**Chalk & Talk**
V	Simple Interest and Compound interest, Time and Work	**12**	**Chalk & Talk**

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 Either or Choice**	**Section C Either or Choice**
			MCQs			
			No. of. Questions	**K - Level**		
CI AI	**CO1**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO2	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
CI AII	**CO3**	**K1 – K5**	2	K1,K2	2(K2,K2)	2(K3,K3)
	CO4	**K1 – K5**	2	K1,K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		**No. of Questions to be asked**	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2			2	3.6	25
	K2	2	10		12	21.4	
	K3		10	16	26	46.4	46.4
	K4			16	16	28.6	28.6
	K5						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.6	7.2
	K2	2			2	3.6	
	K3		10	16	26	46.4	46.4
	K4		10	16	26	46.4	46.4
	K5						
	Marks	4	20	32	56	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	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
2	CO2	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
3	CO3	K1 – K5	2	K1,K2	2(K2,K2)	2(K3,K3)
4	CO4	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
5	CO5	K1 – K5	2	K1,K2	2(K3,K3)	2(K4,K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		10	5
Marks for each question			1		1	8
Total Marks for each section			10		10	40
(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 (Either or Choice**	**Section C (Either/ or Choice)**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
K1	**5**			**5**	**3.6**	**4**
K2	**5**	**20**		**25**	**17.8**	**18**
K3		**30**	**32**	**62**	**44.3**	**44**
K4			**48**	**48**	**34.3**	**34**
Marks	**10**	**50**	**80**	**140**	**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

Q. No.	Unit	CO	K-level		
Answer **ALL** the questions			**PART – A**		**(10 x 1 = 10 Marks)**
1.	**Unit - I**	**CO1**	**K1**		
				a)	b)
				c)	d)
2.	**Unit - I**	**CO1**	**K2**		
				a)	b)
				c)	d)
3.	**Unit - II**	**CO2**	**K1**		
				a)	b)
				c)	d)
4.	**Unit - II**	**CO2**	**K2**		
				a)	b)
				c)	d)
5.	**Unit - III**	**CO3**	**K1**		
				a)	b)
				c)	d)
6.	**Unit - III**	**CO3**	**K2**		
				a)	b)
				c)	d)
7.	**Unit - IV**	**CO4**	**K1**		
				a)	b)
				c)	d)
8.	**Unit - IV**	**CO4**	**K2**		
				a)	b)
				c)	d)
9.	**Unit - V**	**CO5**	**K1**		
				a)	b)
				c)	d)
10.	**Unit - V**	**CO5**	**K2**		
				a)	b)
				c)	d)

Answer **ALL** the questions		**PART – B**		**(5 x 5 = 25 Marks)**
11. a)	**Unit - I**	**CO1**	**K2**	
		OR		
11. b)	**Unit - I**	**CO1**	**K2**	
12. a)	**Unit - II**	**CO2**	**K3**	
		OR		
12. b)	**Unit - II**	**CO2**	**K3**	
13. a)	**Unit - III**	**CO3**	**K2**	
		OR		
13. b)	**Unit - III**	**CO3**	**K2**	
14. a)	**Unit - IV**	**CO4**	**K3**	
		OR		
14. b)	**Unit - IV**	**CO4**	**K3**	
15. a)	**Unit - V**	**CO5**	**K3**	
		OR		
15. b)	**Unit - V**	**CO5**	**K3**	

Answer **ALL** the questions		**PART – C**		**(5 x 8 = 40 Marks)**
16. a)	**Unit - I**	**CO1**	**K3**	
		OR		
16. b)	**Unit - I**	**CO1**	**K3**	
17. a)	**Unit - II**	**CO2**	**K4**	
		OR		
17. b)	**Unit - II**	**CO2**	**K4**	
18. a)	**Unit - III**	**CO3**	**K3**	
		OR		
18. b)	**Unit - III**	**CO3**	**K3**	
19. a)	**Unit - IV**	**CO4**	**K4**	
		OR		
19. b)	**Unit - IV**	**CO4**	**K4**	
20. a)	**Unit - V**	**CO5**	**K4**	
		OR		
20. b)	**Unit - V**	**CO5**	**K4**	

Course Name	Numerical Analysis Using Python			
Course Code	24PMTSP41	**L**	**P**	**C**
Category	Skill	-	4	2

COURSE OBJECTIVES:

- To introduce the concepts and to develop working knowledge on the numerical methods for Mathematical concepts such as differentiation, integration etc to solve these problems using Python programming language

LIST OF PROGRAMMES

1. Find the polynomial for the given data using Newton's Forward Difference formula.
2. Find the polynomial for the given data using Newton's Backward Difference formula.
3. Find the polynomial for the given data using Central Difference formula.
4. Find the polynomial for the given data using Modified Newton's formula.
5. Solve a system of linear equations using Gauss Elimination method.
6. Solve a system of linear equations using Gauss- Jordan method.
7. Solve a system of linear equations using Gauss-Jacobi method.
8. Solve a system of linear equations using Gauss Seidal method.
9. Find a root of a quadratic equation using Newton-Raphson method.
10. Find a root of a cubic equation using Newton-Raphson method.
11. Compute the value of f(x) using Trapezoidal rule.
12. Compute the value of f(x) using Simpson's rule.

Total Lecture Hours **30**

BOOKS FOR REFERENCES:

- P.R. Turner, T. Arildsen, K. Kavanagh, Applied Scientific Computing With Python, Springer International Publishing AG, part of Springer Nature, 2018
- J. M. STEWART, Python for Scientists, Cambridge University Press, 2014
- 2. C. Hill, Learning Scientific Programming with Python, Second Edition, Cambridge University Press, 2020, 2004.

WEB RESOURCES:

- **https://www.w3schools.com/python/python_math.asp**

Nature of Course	EMPLOYABILITY		SKILL ORIENTED	✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓		

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Learn foundations of Python and numerical calculus of Python.	**K1 to K5**
CO2	Study the different elimination and iterative methods and write the Python programs to solve this linear equations	**K1 to K5**
CO3	Obtain the solutions of linear equation using different iterative methods and write the Python programs to solve this linear equations.	**K1 to K5**
CO4	Write the Python programs to find the interpolation	**K1 to K5**
CO5	Write the Python programs to solve quadratic and cubic equatiions	**K1 to K5**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	3	3				
CO2	3	2	3	2	3	3				
CO3	3	2	3	2	3	3				
CO4	3	2	3	2	3	3				
CO5	3	3	3	2	3	3				

S- STRONG **M – MEDIUM** **L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	2		
CO 2	3	2	2		
CO 3	3	2	2		
CO 4	3	2	2		
CO 5	3	2	2		
WEIGHTAGE	15	10	10		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	2		

LESSON PLAN:		
LIST OF PROGRAMMES	**HRS**	**PEDAGOGY**
1. Find the polynomial for the given data using Newton's Forward Difference formula. 2. Find the polynomial for the given data using Newton's Backward Difference formula. 3. Find the polynomial for the given data using Central Difference formula. 4. Find the polynomial for the given data using Modified Newton's formula. 5. Solve a system of linear equations using Gauss Elimination method. 6. Solve a system of linear equations using Gauss- Jordan method. 7. Solve a system of linear equations using Gauss-Jacobi method. 8. Solve a system of linear equations using Gauss Seidal method. 9. Find a root of a quadratic equation using Newton-Raphson method. 10. Find a root of a cubic equation using Newton-Raphson method. 11. Compute the value of f(x) using Trapezoidal rule. 12. Compute the value of f(x) using Simpson's rule.	30	

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)							
Internal	**Cos**	**K Level**	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding & Implementation**	**Debugging & Outpu**
CIA	**CO1**	**K1**	**5**				
	CO2	**K2**		**5**			
	CO3	**K3**			**5**		
	CO4	**K4**				**5**	
	CO5	**K4**					**5**
Question Pattern CIA		**No. of Questions to be asked**	**2**	**2**	**2**	**2**	**2**
		No. of Questions to be answered	**2**	**2**	**2**	**2**	**2**
		Marks for each question	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
		Total Marks for each section	**5**	**5**	**5**	**5**	**5**

Distribution of Marks with K Level CIA									
	K Level	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding**	**Debugging & Output**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
CIA	**K1**	5					**5**	**20**	**20**
	K2		5				**5**	**20**	**20**
	K3			5			5	20	20
	K4				5	5	10	40	40
	Marks						**25**	**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**	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding& Implementation**	**Debugging & Output**
1	**CO1**	**K1**	**15**				
2	**CO2**	**K2**		**15**			
3	**CO3**	**K3**			**15**		
4	**CO4**	**K4**				**15**	
5	**CO5**	**K4**					**15**
No. of Questions to be Asked			**2**	**2**	**2**	**2**	**2**
No. of Questions to be answered			**2**	**2**	**2**	**2**	**2**
Marks for each question			**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Total Marks for each section			**15**	**15**	**15**	**15**	**15**
(Figures in parenthesis denotes, questions should be asked with the given K level)							

Distribution of Marks with K Level CIA									
	K Level	**Syntax & Semantics**	**Programming principles**	**Concept Applications**	**Coding**	**Debugging & Output**	**Total Marks**	**% of (Marks without choice)**	**Consolidated %**
CIA	**K1**	15					**15**	**20**	**20**
	K2		15				**15**	**20**	**20**
	K3			15			15	20	20
	K4				15	1 5	30	40	40
	Marks						**75**	**100**	**100**

Course Name	Extension Activities			
Course Code	24PEXTG41	**L**	**P**	**C**
Category	Extension	-	-	1

Course Description

The students have to attend a 30 hours of Extension activities of their own choice to be carried out in the sixth semester.

Course Description for Extension activities:

1. The Project is conducted by the following Course Pattern. The Extension activities should be minimum 30 hours.
2. Each group should produce permission letter as well as the attendance certificate.
3. There will be one Faculty guide.
4. The students should submit an Extension activities Report (Maximum 30 Pages).
5. The Marks for Extension activities will be awarded only on the basis of the Extension activities Report.
6. Prior permission may be obtained in advance by the students concerned and information shall be passed onto the colleges thus enabling the training supervision by the concerned faculties authorized by the college.
7. Daily postal or electronic reporting should be obtained to ensure coherent and comprehensive activities during the semester.
8. A final report containing the activities report shall be given not exceeding 30 [A4] pages [in a spiral-bound form/pre-printed record designed for this purpose]

Areas Covered:

- Aari work
- Doopstick making
- Art from Waste
- Sambrani making
- Candle making
- Mushroom cultivation
- Silkworm cultivation
- Cucumber cultivation

Internal

Presentation
Submission — **25**

External

Project Report
Viva Voce — **75**

Total - 100

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP						
Curriculum Relevance	LOCAL		REGIONAL	✓	NATIONAL		GLOBAL				
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓					

* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.

COURSE OUTCOMES:		**K LEVEL**
After studying this course, the students will be able to:		
CO1	Explain the student to the environment and expectations of performance on the part of society.	**K1 to K4**
CO2	Able to develop work habits and attitudes necessary for job success. Build a record of work experience.	**K1 to K4**
CO3	Explore the real world in the original situation.	**K1 to K4**
CO4	Expose the student to professional role models by developing communication, interpersonal and other critical skills.	**K1 to K4**
CO5	Examine society-valued skills such as teamwork, communications and attention to detail.	**K1 to K4**

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	3	1	3				
CO2	1	2	2	1	2	1				
CO3	2	2	3	3	2	1				
CO4	3	2	3	2	1	2				
CO5	3	3	3	3	3	3				

3- STRONG **2 – MEDIUM** **1 - LOW**

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	3	2	1		
CO 3	3	2	1		
CO 4	3	2	1		
CO 5	3	2	1		
WEIGHTAGE	15	10	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		