



# **HAJEE KARUTHA ROWTHER HOWDIA COLLEGE**

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

**Uthamapalayam, Theni District. Pin Code: 625 533.**

## **DEPARTMENT OF MATHEMATICS**

### **MASTER OF SCIENCE – MATHEMATICS**

#### **SYLLABUS**

#### **Choice Based Credit System – CBCS**

**(As per TANSCH/MKU Guidelines)**

with

#### **Outcome Based Education (OBE)**

**(Academic Year 2020 -2021 onwards)**

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**Uthamapalayam, Theni District. Pin Code: 625 533.**

**Name of the Programme: M.Sc. Mathematics**

**Choice Based Credit System (CBCS)**

**(As per TANSCHER/MKU Guidelines)**

**with**

**Outcome Based Education (OBE)**

(with effect from the Academic Year 2020 – 2021)

## **College Vision and Mission**

### **Vision**

Our vision is to provide the best type of higher education to all, especially to students hailing from minority Muslim community, rural agricultural families and other deprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duty-bound citizens to take up the challenges of the changing times.

### **Mission**

Our mission is to impart and inculcate social values, spirit of service and religious tolerance as envisioned by our beloved Founder President Hajee Karutha Rowther.

The Vision beckons ..... the Mission continues forever.

## Programme Educational Objectives (PEO)

Our graduates will be progressive, efficient, value based, academically excellent, creative, collaborative, empowered and globally competent literates with the skills required for societal change.

They will demonstrate

<b>PEO1</b>	Comprehensive knowledge and expertise, employability, the acumen of creative and critical thinking, the spirit of enquiry and professional attitude required for a successful career
<b>PEO2</b>	Accountability, linguistic competence and communication skills in the work environment and beyond
<b>PEO3</b>	Perseverance, effective collaboration, team spirit, leadership and problem solving skills
<b>PEO4</b>	Keen sense of civility, professional ethics, receptivity and moral righteousness
<b>PEO5</b>	Commitment to address social and environmental threats and to act as responsible service-minded, duty-bound global citizens

## Department Vision and Mission

### Vision

Department of Mathematics will promote and support a comprehensive, innovative and dynamic learning environment that meets the changing needs of a diverse global students population prepare the young minds for the rapidly changing mathematical techniques.

### Mission

The mission of the mathematics degree program is to equip students with analytic and problem solving skill for career and graduate work classes develop student abilities and aptitudes to apply mathematical methods and ideas not only to problems in mathematics and related field such as the science, computer science, statistics but also to virtually any area of inquiry students learn to communicate ideas effectively and they are encouraged to develop intellectually and to become involved with professional origination. The department cooperates fully with the school of education in meeting its mission for candidates for a degree in education with mathematics.

### **Programme Outcomes (PO)**

On the successful completion of M. Sc., Mathematics programme, the students will be able to

<b>P01</b>	Acquire Knowledge in recent developments in various branches of mathematics and participate in conferences/seminars/workshops and thus pursue research.
<b>P02</b>	Develop problem solving skills and apply them independently to problems in pure and applied mathematics
<b>P03</b>	Sharper their analytic thinking .logical deductions and rigor in reasoning and competent to obtain employment in various sectors.
<b>P04</b>	Competency to meet global challengers through critical, rational, analytical and logical thinking..
<b>P05</b>	Apply mathematical methodologies to open-ended real-world situations.

### **Program Specific Outcomes (PSO)**

A graduate of M. Sc. Mathematics after two years will

<b>PSO1</b>	Communicate Mathematics effectively using various instructional strategies.
<b>PSO2</b>	Utilize skills to write the proof of Mathematical Statements in a Suitable manner and solve theoretical applied problems
<b>PSO3</b>	Acquire computation, Programming and software skill to get empowered With employability and entrepreneurial skills.
<b>PSO4</b>	Develop confidence to defend the various level of competitive examination and get opportunities for personal and career development.
<b>PSO5</b>	Acquire knowledge of the emerging environmental challenges and provide the possible contribution in sustainable development that integrates Environment, Economy, Society and the Nation.

## **Programme Scheme**

### **Eligibility**

A candidate who has passed B.Sc., Mathematics as the Major subject with Physics Ancillary is eligible for the Master of Science – Physics Degree.

Duration of the Course: M.Sc., Mathematics – 2 years (4 Semesters).

Medium of instruction: English.

### **For Programme Completion**

A Candidate shall complete:

- Part III - Core papers in semesters I, II, III and IV respectively
- Part III - Elective papers in semesters I, II, III and IV respectively
- Part IV - Non- Major Elective papers in semester III

### **Scheme of Examinations under Choice Based Credit System**

Term End Examinations (TEE)	- 75 Marks
Continuous Internal Assessment Examinations (CIAE)	- 25 Marks
Total	- 100 Marks

### **Pattern of Continuous Internal Assessment Examinations (CIAE)**

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Seminar / Quiz / Assignment	- 05 Marks
Total	- 25 Marks

### **Pattern of Term End Examinations**

**(Max. Marks: 75 / Time: 3 Hours)**

#### **External Examinations Question Paper Pattern**

Section – A (10 X 1 = 10 Marks)

Answer ALL questions.

- Questions 1 - 10
- Two questions from each unit
- Multiple choice questions and each question carries Four choices

Section – B (5 X 7 = 35 Marks)

Answer ALL questions choosing either A or B.

- Questions 11 - 15
- Two questions from each unit (either.... or.... type)
- Descriptive Type

Section – C (3 X 10 = 30 Marks)

Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Descriptive Type

## Passing Marks

Minimum 34 for External Exam

Eligibility for the degree – passing minimum is **50%**

## Practical Examination

Internal – 40 marks

External – 60 marks

Total – 100 marks

Passing minimum is **40%**

## Weightage

Weightage for Bloom's Taxonomy	Percentage	Marks	
		CIAE	TEE
Knowledge (Remembering) – K1	10	2	7
Understanding – K2	10	3	8
Applying – K3	20	5	15
Analyzing – K4	20	5	15
Evaluating – K5	40	10	30
<b>Gross Total</b>	<b>100</b>	<b>25</b>	<b>75</b>

## Assessment

### Distribution of questions and marks for Continuous Internal Assessment Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	3 (3)	1 (a or b) (4)	-----	<b>40 Marks</b>
Understanding(K2)	3 (3)	1 (a or b) (4)	-----	
Apply(K3)	1 (1)	1 (a or b) (4)	1 (8)	
Analyzing (K4)	1 (1)	1 (a or b) (4)	1 (8)	
CIA Examinations conducted for 40 marks and converted to 20 marks				<b>40/2 = 20</b>
Evaluating (K5)	Seminar, Quiz/Assignments			<b>10/2 = 5</b>

### Distribution of questions and marks for Term End Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	7 (7)	-----	-----	<b>Total 75 Marks</b>
Understanding(K2)	1 (1)	1 (a or b) (7)	-----	
Apply(K3)	1 (1)	2 (a or b) (14)	-----	
Analyzing (K4)	1 (1)	2 (a or b) (14)	-----	
Evaluating (K5)	-----	-----	3 out of 5 (30)	

**Note: Figures in parenthesis are Marks**

## Details of Course Category, Code, Credits & Title

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
<b>Semester - I</b>							
<b>Part - III (OBE)</b>							
Core - I	20PMAC11	Groups & Rings	6	25	75	100	5
Core - II	20PMAC12	Real Analysis	6	25	75	100	4
Core - III	20PMAC13	Differential Equations	6	25	75	100	4
Core - IV	20PMAC14	Graph Theory	6	25	75	100	5
Elective - I	20PMAE11	Mechanics	6	25	75	100	5
	20PMAE12	Numerical Analysis					
<b>Total</b>			<b>30</b>			<b>500</b>	<b>23</b>
<b>Semester - II</b>							
<b>Part - III (OBE)</b>							
Core - V	20PMAC21	Linear Algebra	6	25	75	100	4
Core - VI	20PMAC22	Complex Analysis	6	25	75	100	5
Core - VII	20PMAC23	Differential Geometry	6	25	75	100	4
Core - VIII	20PMAC24	Mathematical Statistics	6	25	75	100	5
Elective - II	20PMAE21	Combinatorial Mathematics	6	25	75	100	5
	20PMAE22	Fuzzy sets & Logics					
<b>Total</b>			<b>30</b>			<b>500</b>	<b>23</b>



Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
<b>Semester - III</b>							
<b>Part - III (OBE)</b>							
Core - IX	20PMAC31	Field Theory & Lattices	7	25	75	100	4
Core - X	20PMAC32	Measure Theory	7	25	75	100	4
Core - XI	20PMAC33	Mathematical Methods	7	25	75	100	4
Elective -III	20PMAE31	Number Theory	6	25	75	100	4
	20PMAE32	Cryptography					
<b>Part - IV</b>							
NME	20PMAN31	Mathematics for Competitive Examinations	3	25	75	100	3
<b>Total</b>			<b>30</b>			<b>500</b>	<b>19</b>
<b>Semester - IV</b>							
<b>Part - III (OBE)</b>							
Core - XII	20PMAC41	Topology	6	25	75	100	5
Core - XIII	20PMAC42	Functional Analysis	6	25	75	100	5
Core - XIV	20PMAC43	Optimization Techniques	6	25	75	100	5
Core - XV	20PMAC44	Project	7	25	75	100	5
Elective - IV	20PMAE41	Fluid Dynamics	5	25	75	100	5
	20PMAE42	Modern Applied Algebra					
<b>Total</b>			<b>30</b>			<b>500</b>	<b>25</b>
<b>Grand Total</b>			<b>120</b>			<b>2000</b>	<b>90</b>

Course Code	Course Title	Category	Total Hours	Credits
20PMAC11	Groups and Rings	Core - I	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course demonstrates the Sylow subgroups, solvability of groups and the structure theorem for finite abelian groups. The chain conditions in rings are elaborately discussed.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Find the number of subgroups in a group.	K1,K2,K3,K4
C02	Demonstrate and analyze the concepts of solvability of Group	K1,K2,K3,K4
C03	Examine advanced ideas in the algebraic structures	K1,K2,K3,K4
C04	Solve the irreducibility of polynomials	K1,K2,K3,K4
C05	Explain chain conditions in Rings	K1,K2,K3,K4,K5

K1-Knowledge

K2-Understand

K3-Apply

K4- Analyse

K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	3	3	3
C02	2	2	1	3	2
C03	3	3	3	2	3
C04	3	2	2	3	2
C05	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	3	3
CO2	3	3	1	2	3
CO3	1	2	2	3	2
CO4	2	3	3	2	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

**UNIT I** 18 Hours

A counting principle - Normal subgroups and Quotient groups - Homomorphisms - Automorphisms - Cayley's theorem - Permutation groups.

**UNIT II** 16 Hours

Another counting principle - Sylow's theorem - Direct products - Finite Abelian groups.

**UNIT III** 18 Hours

Euclidean Ring - A particular Euclidean Ring - Polynomial Rings - Polynomials over the Rational fields.

**UNIT IV** 20 Hours

Generators of a subgroup - Derived subgroups - Normal series - Solvable groups - Composition series - Zassenhaus lemma - Schrier's Refinement theorem - Jordan-Holde theorem.

**UNIT V** 18 Hours

Noetherian Rings - Artinian Rings.

## Text Books

Herstein, I.N., "*Topics in Algebra*", Wiley Student Edition 2014, India.

Surjeet Singh and Qazi Zameeruddin, "*Modern Algebra*", Vikas Publishing House Pvt. Ltd., 2015, New Delhi.

**Unit - I:** Book- 1: Chapter -2 Section -2.2-2.10

**Unit - II:** Book-1: Chapter -2 Section-2.11-2.14

**Unit -III:** Book-1: Chapter-3 Section-3.7-3.11

**Unit -IV:** Book-2: Chapter 4 Section-4.1-4.8

**Unit - V:** Book-2: Chapter 5 Section-5.1-5.2

## Reference Books

Vijay K Khanna and S.K. Bhambri, "*A course in Abstract Algebra*", VikasPublishing House Pvt. Ltd., 2015, New Delhi.

Richard M. Foote and David S. Dummit, "*Abstract Algebra*", John Wiley Publications, 2011, New York.

Joseph A Gallian, "*Contemporary Abstract Algebra*", Narosa Publication, NewDelhi, 1999.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	A counting principle - Normal subgroups and Quotient groups	6	Chalk & Talk
1.2	Homomorphisms –Automorphisms.	6	PPT
1.3	Cayley's theorem - Permutation groups.	6	PPT
<b>UNIT - II</b>			
2.1	Another counting Principal	4	Discussion
2.2	Sylow's Theorem	4	Chalk & Talk
2.3	Direct Product	4	E-Resources
2.4	Finite Abelian Groups	4	Chalk & Talk
<b>UNIT - III</b>			
3.1	Euclidean Rings	2	E-Resources
3.2	A Particular Euclidean Ring	4	Chalk & Talk
3.3	Polynomial Ring	4	Discussion
3.4	Polynomials over the rational field	4	Chalk & Talk
3.5	Polynomial rings over commutative Rings	4	Discussion
<b>UNIT - IV</b>			
4.1	Generators of subgroup	2	Discussion
4.2	Derived subgroups	2	E-Resources
4.3	Normal series	4	Chalk & Talk
4.4	Solvable groups	4	Discussion
4.5	Composition series	2	E-Resources

4.6	Zassenhaus lemma	2	Chalk & Talk
4.7	Schrier's Refinement Theorem	2	Discussion
4.8	Jordan-Holder theorem	2	E-Resources
<b>UNIT - V</b>			
5.1	Noetherian Rings	9	Chalk & Talk
5.2	Artinian Rings	9	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Mr. M.Vignesh Babu**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC12	Real Analysis	Core - II	90	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course covers the analysis of integration, uniform convergence of sequence and series of functions. Uniform convergence plays a key role in finding approximate solutions to theoretical and practical problems.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall and apply the concepts of continuity, discontinuity, compactness and connectedness in metric spaces.	K1,K2,K3,K4
CO2	Demonstrate the differentiation of functions of real Variables	K1,K2,K3,K4
CO3	Evaluate the integral of functions of a real variable in the sense of Riemann Stieltjes	K1,K2,K3,K4,K5
CO4	Identify and classify the sequence of functions which point wise convergence and uniform convergence	K1,K2,K3,K4,K5
CO5	Analyze the structure of the exponential and logarithmic functions, the trigonometric functions, the gamma functions	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	2	1	1	3	3
CO2	3	3	2	2	2
CO3	2	2	2	3	3
CO4	3	3	2	3	2
CO5	2	3	2	2	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	3	3
CO2	1	3	2	2	2
CO3	3	3	2	3	3
CO4	2	3	1	3	2
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Continuity: Limits of functions – Continuous Functions – Continuity and Compactness - Continuity and Connectedness – Discontinuities – Monotonic Functions – Infinite Limits and Limits at infinity.

### UNIT II

18 Hours

Differentiation: The Derivative of a Real Function – Mean Value Theorems – The Continuity of Derivatives– L'Hospital's Rule – Derivatives of Higher Order – Taylor's Theorem– Differentiation of vector -valued functions.

### UNIT III

18 Hours

The Riemann – Stieltjes Integral: Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector – Valued Functions –Rectifiable Curves.

### UNIT IV

18 Hours

Sequences and Series of Functions: Discussion of Main Problem –Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration –Uniform Convergence and Differentiation.

### UNIT V

18 Hours

Equicontinuous Families of Functions – The Stone – Weierstrass Theorem – Some Special Functions: Power Series – The Exponential and Logarithmic Functions – The Trigonometric functions– The Algebraic Completeness of the Complex Field – The Gamma Function.

## Text Books

Walter Rudin., "*Principles of Mathematical Analysis*", Third Edition McGraw – Hill Education (India) Pvt. Ltd., New Delhi, 2013.

**Unit -I:** Chapter -4 (Full), **Unit -II:** Chapter-5 (Full)

**Unit -III:** Chapter-6 (Full), **Unit -IV:** Chapter- 7 (Pages143-154)

**Unit -V:** Chapter -7 (Pages155-161), Chapter-8 (Pages172-185 & 192-195)

## Reference Books

Karunakaran. V., "*Real Analysis, Pearson*", Chennai, 2012.

Stephen Abbott, "*Understanding Analysis*", Springer Verlag, New York, 2010.

Tom M. Apostol, "*Mathematical Analysis*", A Modern Approach to Advanced Calculus, Addison-Wesley Publishing Company, United States, 1969.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Limits of functions	1	Chalk & Talk
1.2	Continuous Functions	1	E-Resources
1.3	Continuity and Compactness	2	Discussion
1.4	Continuity and Connectedness	3	Chalk & Talk
1.5	Discontinuities	3	E-Resources
1.6	Monotonic Functions	4	Discussion
1.7	Infinite Limits and Limits at Infinity	4	Chalk & Talk
<b>UNIT - II</b>			
2.1	The Derivative of a Real Function	2	E-Resources
2.2	Mean Value Theorems	2	Discussion
2.3	L'Hospital's Rule	2	Chalk & Talk
2.4	Derivatives of Higher Order	4	E-Resources
2.5	Taylor's Theorem	4	Discussion
2.6	Differentiation of vector-valued functions	4	Chalk & Talk
<b>UNIT - III</b>			
3.1	Properties of the Integral	4	E-Resources
3.2	Integration and Differentiation	4	Discussion
3.3	Integration of vector-valued functions	6	Chalk & Talk
3.4	Rectifiable Curves	4	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Discussion of Main Problem	4	PPT
4.2	Uniform Convergence and Continuity	6	PPT



4.3	Uniform Convergence and Integration	4	PPT
4.4	Uniform Convergence and Differentiation.	4	Chalk & Talk
<b>UNIT - V</b>			
5.1	Equicontinuous Families of Functions	4	Discussion
5.2	The Stone –Weierstrass Theorem	3	PPT
5.3	Power Series	2	Discussion
5.4	The Exponential and Logarithmic Functions	4	Discussion
5.5	The Trigonometry Functions	2	PPT
5.6	The Gamma Function	3	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. A. Benazir**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC13	Differential Equations	Core - III	90	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	✓
National	
Global	✓

### Preamble

The course provides mathematical methods to solve higher order differential equations and understand the concept of power series solution, special functions, existence and uniqueness of solutions of ordinary differential equations and stability by Liapunov's direct method.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Apply concept Reduction of the order of a homogeneous equation, The wronskian and linear independence	K1,K2,K3,K4
CO2	Explain, Second order equations with regular singular points, The Bessel equation	K1,K2,K3,K4,K5
CO3	Analyze and solve The Lipschitz condition, Convergence of The successive approximations,	K1,K2,K3,K4
CO4	Find the Origins of first order Partial Differential Equations-Cauchy's problem for first order equations	K1,K2,K3,K4
CO5	Demonstrate Cauchy's method of Characteristics - Compatible Systems of first order equations-Charpit's method-Special types of first order equations.	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	2	3	1	3	3
CO2	1	2	2	3	2
CO3	2	3	2	3	3
CO4	3	2	2	3	3
CO5	3	3	2	3	2

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	3	1	3	1
CO3	3	3	3	2	3
CO4	2	2	2	3	2
CO5	3	3	2	2	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Introduction, Initial value problems for the homogeneous equation, Solutions of the homogeneous equation, The wronskian and linear independence, Reduction of the order of a homogeneous equation, The non-homogeneous equation, Homogeneous equations with analytic coefficients, The Legendre equation.

### UNIT II

18 Hours

Introduction, The Euler equation, Second order equations with regular singular points- an example, Second order equations with regular singular points- the general case. A convergence proof, The Exponential cases, The Bessel equation, The Bessel equation (continued).

### UNIT III

18 Hours

Introduction, Equations with variables separated, Exact equations, The method of successive approximations, The Lipschitz condition, Convergence of the successive approximations, Non-local existence of solutions, Approximations to and uniqueness of solutions.

### UNIT IV

18 Hours

Partial differential equations –Origins of first order Partial differential equations- Cauchy’s problem for first order Equations-Linear equations of the first Order- Integral surfaces passing through a given curve.

### UNIT V

18 Hours

Nonlinear Partial differential equations of the first Order-Cauchy’s method of Characteristics-Compatible Systems of first order equations-Charpit’s Method- Special types of first order equations.

## Text Books

Coddington. E. A “*An introduction to Ordinary differential equations*”, Prentice Hall of India, 1987.

Sneddon.I.N., “ *Elements of Partial differential equations*” Tata McGraw Hill Book Company, 1986.

**Unit - I:** Book: 1Chapter 3 Sections 1 to 8

**Unit - II:** Book: 1 Chapter 4, Sections 1 to 8

**Unit - III:** Book: 1 Chapter 5, Sections 1 to 8

**Unit - IV:** Book2: Chapter 2, Sections 2.1 to 2.5

**Unit - V:** Book2: Chapter 2, Sections 2.6 to 2.11

## Reference Books

Simmons.G. F and Krantze, “ *Differential Equations*”, 3rd Edition, Tata McGraw HillPublishing company, 2006.

Amarnath.T “*An elementary course in PDE*” Naraso Publication, 1997.

Rukmangadachari. E differential equation Dorling Kindersley India Pvt.Ltd, 2012.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Introduction	1	Chalk & Talk
1.2	Initial value problems for The homogeneous equation,	1	PPT
1.3	Solutions of the homogeneous equation,	2	E-Resources
1.4	The wronskian and linear independence,	2	Chalk & Talk
1.5	Reduction of the order of a homogeneous equation,	2	PPT
1.6	The non-homogeneous equation	3	E-Resources
1.7	Homogeneous equations with analytic coefficients	3	PPT
1.8	The Legendre equation	4	Chalk & Talk

<b>UNIT - II</b>			
2.1	Introduction ,	4	Discussion
2.2	The Euler equation	2	Chalk & Talk
2.3	Second order equations with regular singular points- an example	2	E-Resources
2.4	Second order equations with regular singular points	2	Discussion
2.5	The general case	2	Chalk & Talk
2.6	A convergence proof	2	Chalk & Talk
2.7	The Bessel equation	2	E-Resources
2.8	The Bessel equation (continued)	2	Discussion
<b>UNIT - III</b>			
3.1	Introduction	1	E-Resources
3.2	Equations with variables separated	2	Chalk & Talk
3.3	Exact equations	2	Discussion
3.4	The method of successive approximations	4	Chalk & Talk
3.5	The Lipschitz condition,	3	E-Resources
3.6	Convergence of the successive approximations	2	Chalk & Talk
3.7	Non-local existence of solutions	2	Discussion
3.8	Approximations to and uniqueness of solutions	2	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Partial differentia equations	4	Discussion
4.2	Origins of first order Partial differential equations	2	E-Resources
4.3	Cauchy's problem for first order equations	2	Chalk & Talk
4.4	Linear equations of the first order	4	Chalk & Talk
4.5	Integral surfaces passing through a given curve	4	Chalk & Talk
4.6	Partial differentia equations	4	Discussion

<b>UNIT - V</b>			
5.1	Nonlinear Partial differential equations of the first order	3	E-Resources
5.2	Cauchy's method of characteristics	3	Chalk & Talk
5.3	Compatible Systems of first order equations	2	Discussion
5.4	Charpit's method	2	Chalk & Talk
5.5	Special types of first order equations	4	Chalk & Talk
5.6	First order equations	4	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. D. Gowsalya**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC14	Graph Theory	Core - IV	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course deals with the graph theoretical concepts connectivity, planarity and distance that help to model real life situations.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Relate connectivity concepts in the theory of network flow problems	K1,K2,K3,K4
C02	Analyze and Apply planarity concepts in computer graphics	K1,K2,K3,K4,K5
C03	Apply the distance concepts in channel Assignment	K1,K2,K3,K4
C04	Explain matching concepts in job assignment problems	K1,K2,K3,K4,K5
C05	Develop mathematical models of real life problems using domination	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	1	3	3
C02	2	3	2	3	2
C03	2	3	3	2	3
C04	3	3	2	3	3
C05	3	1	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2
CO2	3	2	1	3	3
CO3	3	3	2	2	3
CO4	3	3	2	1	2
CO5	3	3	3	3	3

1-Low

2-Medium

3-Strong

## Syllabus

**UNIT I** 18 Hours

Connectivity: Cut–Vertices – Blocks – Connectivity – Manger’s Theorem.

**UNIT II** 18 Hours

Matching’s and Factorization: Matching’s –Factorization– Decompositions and Graceful Labeling.

**UNIT III** 18 Hours

Planarity: Planar Graphs – Embedding Graphs on Surfaces.

**UNIT IV** 18 Hours

Coloring: The Four Color Problem – Vertex Coloring – Edge Coloring.

**UNIT V** 18 Hours

Distance: The Center of a Graph – Distant Vertices – Channel Assignment, Domination: The domination number of a graph.

## Text Books

Gary Chartrand and Ping Zhang, *Introduction to Graph Theory*, Tata McGraw – Hill, New Delhi, 2006.

**Unit – I:** Chapter Sections 5.1-5.4

**Unit – II:** Chapter 8, Section 8.18.3

**Unit – III:** Chapter 9, Sections 9.1 - 9.2

**Unit –IV:** Chapter 10, Sections 10.1 – 10.3

**Unit – V:** Chapter 12, Sections 12.1, 12.2, 12.5 and Chapter 13, Section 13.1

## Reference Books

Balakrishnan R. and Ranganathan. K., *“A Textbook of Graph Theory”*, 2<sup>nd</sup> Edition, Springer Verlag, New York, 2012.

Bondy, J.A. and Murthy. U.S.R., *“Graph Theory”*, Springer-Verlag, London, 2008.

Douglas B. West, to *“Introduction Graph Theory”* “Prentice Hall of India, Singapore, 2001.

Harary, *“Graph Theory”*, Narosa Publishing House, New Delhi, 1989.



## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Connectivity : Cut- Vertices	2	Chalk & Talk
1.2	Blocks	4	E-Resources
1.3	Connectivity	6	Discussion
1.4	Menger's Theorem	6	Chalk & Talk
<b>UNIT - II</b>			
2.1	Matchings and Factorization: Matchings	6	Discussion
2.2	Factorization	6	Chalk & Talk
2.3	Decompositions, Graceful Labelings	6	E-Resources
<b>UNIT - III</b>			
3.1	Planarity: Planar Graphs	9	E-Resources
3.2	Embedding Graphs on Surfaces	9	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Coloring: The Four Color Problem	9	Discussion
4.2	Vertex Coloring Edge Coloring	9	E-Resources
<b>UNIT - V</b>			
5.1	Distance: The Center of a Graph -Distant	6	E-Resources
5.2	Vertices – Channel Assignment	4	Chalk & Talk
5.3	Domination: The domination number of a graph	4	Discussion
5.4	Connectivity : Cut-Vertices	4	Chalk & Talk
<b>Total</b>		<b>90</b>	

## Course Designer

**Ms. M. VijayaSankari**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAE11	Mechanics	Elective -I	90	5

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course deals with Hamiltonian's Principles and Lagrange's equations. Poisson and Jacobi brackets are classified through canonical transformations.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Recall the elementary principles of mechanics	K1,K2,K3,K4
C02	Analyze and Demonstrate the Holonomic and non-Holonomic systems	K1,K2,K3,K4
C03	Solve one body central force problems	K1,K2,K3,K4
C04	Evaluate an orbit equation for the Kepler Problem by using the Laplace-Runge - Lenz vector	K1,K2,K3,K4,K5
C05	Define and solve the equations of canonical transformations	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	1	2	3
C02	3	2	1	3	2
C03	3	3	2	3	3
C04	3	3	3	3	3
C05	3	3	2	2	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	3
CO2	3	3	1	3	3
CO3	3	2	2	3	3
CO4	3	2	2	3	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Mechanics of a particle, Mechanics of a system of particles, Constraints D'Alembert's Principle and Lagrange's equations, velocity-dependent potentials and the dissipation function, Hamilton's principle, some techniques of the calculus of variations.

### UNIT II

18 Hours

Derivation of Lagrange's equation from Hamilton's principle, Extension of Hamilton's principle to nonholonomic systems, Conservation theorems and symmetry properties.

### UNIT III

18 Hours

Reduction to the equivalent one-body problem, The equations of motion and first integrals, The Virial theorem.

### UNIT IV

18 Hours

The Differential equation for the orbit and integral power - law potentials, conditions for closed orbits (Bertrand's theorem) The Kepler problem Inverse square law of force, the motion in time in the Kepler problem, the Laplace - Runge-Lenz vector.

### UNIT V

18 Hours

Canonical transformation: The equations of canonical Transformation - Examples of canonical Transformations-Poisson brackets and other canonical invariants.

## Text Books

Herbert Goldstein, "*Classical Mechanics*", Second Edition, Narosa Publishing House. 2002.

**Unit I:** Book-1 Chapter -1 Section -1.1-1.5,

**Unit II:** Book-1 Chapter-2 Section 2.1, 2.2

**Unit III:** Book-1 Chapter -2 Section-2.3, 2.4 and 2.6

**Unit IV:** Book-1 Chapter -3 Section-3.1, 3.2 and 3.4

**Unit V:** Book-1 Chapter -9 Section 9.1, 9.2, 9.4

## Reference Books

Gupta, Kumar, Sharma," *Classical Mechanics*", 2012 Pragati Prakashan.

Bhatia V.B.," *Classical Mechanics*", Narosa Publishing House

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Mechanics of a particle, Mechanics of a system of particles	2	Discussion
1.2	Constraints D"Alembert"s Principle Lagrange's equations, velocity	4	E-Resources
1.3	dependent potentials and the dissipation function	4	Chalk & Talk
1.4	Hamilton's principle	4	E-Resources
1.5	some techniques of the calculus of variations	4	Chalk & Talk
<b>UNIT - II</b>			
2.1	Another counting Principal	4	Chalk & Talk
2.2	Sylow's Theorem	5	Chalk & Talk
2.3	Direct Product	5	Chalk & Talk
2.4	Finite Abelian Groups	4	Chalk & Talk
<b>UNIT - III</b>			
3.1	Euclidean Rings	2	Chalk & Talk
3.2	A Particular Euclidean Ring	4	E-Resources
3.3	Polynomial Ring	4	Chalk & Talk
3.4	Polynomials over the rational field	4	E-Resources
3.5	Polynomial rings over commutative rings	4	Discussion
<b>UNIT - IV</b>			
4.1	Generators of subgroup	2	Chalk & Talk
4.2	Derived subgroups	2	E-Resources
4.3	Normal series	3	Discussion

4.4	Solvable groups	3	Chalk & Talk
4.5	Composition series	2	PPT
4.6	Zassenhaus lemma	2	PPT
4.7	Schrier's Refinement theorem	2	E-Resources
4.8	Jordan-Holder theorem	2	Discussion
<b>UNIT - V</b>			
5.1	Noetherian Rings	9	E-Resources
5.2	Artinian Rings	9	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. A. Benazir**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAE12	Numerical Analysis	Elective - I	90	5

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course provides mathematical methods to solve higher order differential equations and understand the concept of power series solution, special functions, existence and uniqueness of solutions of ordinary differential equations and stability by Liapunov's direct method.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	How to find complex roots	K1,K2,K3,K4
CO2	Demonstrate and Analyze Eigen values and Eigen vectors	K1,K2,K3,K4
CO3	Apply finite difference in Interpolating Polynomials	K1,K2,K3,K4,K5
CO4	Classify and Explain Differentiation and Integration in Numerical Methods	K1,K2,K3,K4,K5
CO5	Analyze Initial value problems in Ordinary differential equations	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	3	2
CO2	2	2	1	3	3
CO3	2	3	3	3	3
CO4	3	3	3	2	2
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	3
CO2	2	3	1	3	3
CO3	3	3	2	3	3
CO4	2	3	3	2	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

**Transcendental and Polynomial Equations:** Iteration methods based on second degree equation- General iteration methods-system of nonlinear equations- Methods for complex Roots-Polynomial equations.

### UNIT II

18 Hours

**System of Linear Algebraic Equations and Eigen Value Problems:** Introduction, Direct methods, - Iteration Methods-Eigen values and Eigen vectors, Jacobi method for symmetric matrices.

### UNIT III

18 Hours

**Interpolation and Approximation:** Introduction, Lagrange and Newton interpolations, Finite difference Operators, interpolating polynomials using finite differences, Hermite interpolation.

### UNIT IV

18 Hours

**Differentiation and Integration** - Introduction, Numerical Differentiation, Extrapolation methods, Partial Differentiation, Numerical integration, Methods based on interpolation, Composite integration methods, Romberg Integration.

### UNIT V

18 Hours

**Ordinary Differential Equations: Initial Value Problems-** Introduction, Difference equations, Numerical methods, Single step methods, Multi step Methods-Predictor- Corrector Methods.

## Text Books

Jain M.K., Iyengar S. R. K. and Jain. R. K, "**Numerical Methods for Scientific and Engineering Computation**", 6<sup>th</sup> Edition, New Age International Publishers, 2012.

**Unit – I:** Chapter -2 Section -2.4, 2.6, 2.7, 2.8, 2.9

**Unit – II:** Chapter -3 Section-3.1, 3.2, 3.4 (Omitting SOR method, convergence Analysis of Iterative methods, Optimal Relaxation parameter for the SOR method, Iterative method to determine A-1), 3.5, 3.7

**Unit – III:** Chapter-4 Section-4.1-4.5

**Unit – IV:** Chapter 5 Section 5.1, 5.2, 5.4-5.7, 5.9, 5.10

**Unit – V:** Chapter 6 Section 6.1-6.4, 6.6, 6.7

## Reference Books

Kandasamy. P., Thilagavathy., K Gunavathi.K., "**Numerical Methods**", Sultanch and, 2006.

Sastry. S.S., "**Introductory Methods of Numerical Analysis**", Fourth Edition, PHI Learning Private Ltd. 2009.

Dr. VedamurthV.Ny, Dr. Ch. S.N. Iyengar. "**Numerical Methods**", Vikas Publishing House, 2011.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Iteration Methods Based on Second Degree Equation	2	E-Resources
1.2	General Iteration Methods	3	Chalk & Talk
1.3	system of nonlinear equations	4	Chalk & Talk
1.4	Methods for complex roots	5	E-Resources
1.5	Polynomial equations.	4	Discussion
<b>UNIT - II</b>			
2.1	Introduction, Direct methods	4	Chalk & Talk
2.2	Iteration methods	4	E-Resources
2.3	Eigen values and Eigen vectors	5	Discussion
2.4	Jacobi method for symmetric matrices	5	Chalk & Talk
<b>UNIT - III</b>			
3.1	Introduction, Lagrange and Newton interpolations	2	Chalk & Talk
3.2	Finite difference Operators	5	Chalk & Talk
3.3	Interpolating polynomials using finite differences	5	E-Resources
3.4	Hermite interpolation	5	Discussion



<b>UNIT - IV</b>			
4.1	Introduction, Numerical Differentiation	1	Discussion
4.2	Extrapolation methods	3	E-Resources
4.3	Partial Differentiation	3	Chalk and Talk
4.4	Numerical integration	3	Chalk and Talk
4.5	Methods based on interpolation	4	Discussion
4.6	Composite integration methods	2	E-Resources
4.7	Romberg Integration	2	Discussion
<b>UNIT - V</b>			
5.1	Introduction, Difference equations	4	E-Resources
5.2	Numerical methods	4	Chalk & Talk
5.3	Single step methods	3	Discussion
5.4	Multi-step Methods	4	Chalk & Talk
5.5	Predictor-Corrector Methods.	3	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. A. Benazir**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC21	Linear Algebra	Core - V	90	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

### Preamble

The course deals with the relation between a linear transformation and its matrix. Various properties of transformations are discussed through matrices.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Recall and demonstrate the concept of dual spaces and inner product spaces	K1,K2,K3,K4
C02	Analyze and Construct Algebra of Transformation	K1,K2,K3,K4
C03	Determine canonical forms and nilpotent transformations	K1,K2,K3,K4,K5
C04	Determine Rational canonical forms trace and transpose	K1,K2,K3,K4,K5
C05	Demonstrate the Hermitian, Unitary and normal transformations	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	2	3	1	1	3
C02	3	2	1	3	3
C03	3	3	2	3	1
C04	1	2	2	1	3
C05	3	3	2	3	1

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	1	3	1	3	3
CO3	1	3	2	3	2
CO4	3	2	2	3	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

**UNIT I** 18 Hours

Linear independence and bases, Dual spaces, Inner product spaces.

**UNIT II** 18 Hours

Modules, the algebra of linear transformation, characteristic roots, matrices.

**UNIT III** 18 Hours

Canonical forms, Triangular form, Nilpotent transformations, A decomposition of V: Jordan form.

**UNIT IV** 18 Hours

Canonical forms, Rational canonical form, Trace and Transpose.

**UNIT V** 18 Hours

Determinants, Hermitian, Unitary and Normal Transformations, real quadratic forms.

## Text Books

Herstein., I.N., "*Topics in Algebra*", John Wiley and sons, 2<sup>nd</sup> Edition, 1999.

**UNIT I:** Chapter 4 – Section 4.2 to 4.4

**UNIT II:** Chapter 4 - Section 4.5, Chapter 6 - Section 6.1 to 6.3

**UNIT III:** Chapter 6 - Section 6.4, 6.5 and 6.6

**UNIT IV:** Chapter 6 - Section 6.7 and 6.8

**UNIT V:** Chapter 6 – Section 6.9 and 6.10

## Reference Books

Joseph Gallian. A., *Contemporary Abstract Algebra*, Narosa Publication, New Delhi, 1999.

Kenneth Hoffman and Ray Kunze., *Linear Algebra*, PHI Learning Pvt. Ltd., New Delhi, 2009.

Vijay K Khanna and Bhambri, S.K., *A course in Abstract Algebra*, Vikas Publishing House Pvt. Ltd., Chennai, 2012.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Linear independence and bases	6	Chalk & Talk
1.2	Dual spaces	6	E-Resources
1.3	Inner product spaces	6	Discussion
<b>UNIT - II</b>			
2.1	Modules	4	Discussion
2.2	The algebra of linear transformations	5	Chalk & Talk
2.3	Characteristic roots	4	E-Resources
2.4	Matrices	5	Chalk & Talk
<b>UNIT - III</b>			
3.1	Canonical forms -Triangular forms	6	E-Resources
3.2	Nilpotent transformation	6	Chalk & Talk
3.3	A decomposition of V:Jordan form.	6	Discussion
<b>UNIT - IV</b>			
4.1	Canonical forms Rational canonical form	9	Discussion
4.2	Trace and Transpose.	9	E-Resources
<b>UNIT - V</b>			
5.1	Determinants	9	Chalk & Talk
5.2	Hermitian, Unitary and Normal Transformation real quadratic forms	9	E-Resources
<b>Total</b>		<b>90</b>	

## Course Designer

**Ms. A. Benazir**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC22	Complex Analysis	Core - VI	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course introduces limit, continuity and differentiability of functions of complex variables. Complex functions are expanded as Taylor and Laurent's series. Contour integrals are evaluated using residues.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall and Analyze the concept in complex functions	K1,K2,K3,K4
CO2	Define and Evaluate complex integrals	K1,K2,K3,K4,K5
CO3	Classify elliptic function and analyze their properties	K1,K2,K3,K4
CO4	Find the Taylor and Laurent series expansions for complex functions	K1,K2,K3,K4,K5
CO5	Analyze and construct Elliptic functions	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	3	3
CO2	3	1	1	1	3
CO3	2	3	2	3	2
CO4	3	2	2	2	3
CO5	1	3	2	3	1

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	2	1	2	3	1
CO4	3	3	2	2	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Complex Functions: Introduction to the concept of analytic functions – Limits and Continuity – Analytic functions – Polynomials – Rational functions. Elementary theory of Power series – Sequences, Series, Uniform Convergence, Power Series, Abel's Limit theorem – The Exponential and Trigonometric Functions: The Exponential, the Trigonometric Functions – The Periodicity – The Logarithm.

### UNIT II

18 Hours

Complex Integration: Fundamental Theorems – Line Integrals, Rectifiable arcs – Line Integrals as Functions of arcs – Cauchy's theorem for a rectangle – Cauchy's theorem in a disk – Cauchy's Integral formula – Index of a point – Integral Formula – Higher derivatives – Local Properties of Analytical Functions – Removable singularities – Taylor's theorem – Zeros and poles – The Local mapping – The Maximum Principle.

### UNIT III

18 Hours

Complex Integration: Calculus of Residues- Residue theorem, Argument Principle, Evaluation of definite Integrals. Harmonic Functions- Definition and Basic properties, the Mean- value Property, Poisson's Formula.

### UNIT IV

18 Hours

Series and Product Development: Power Series Expansions: Weierstrass's Theorem – The Taylor Series – The Laurent Series – Partial Fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products – The Gamma Function – Entire functions: Jensen's Formula – Hadamard's theorem.

### UNIT V

18 Hours

Elliptic Functions: Doubly Periodic Functions – The Period Module – Unimodular Transformations – The Canonical Basis – The General Properties of Elliptic Functions – Weierstrass Theory – Weierstrass  $p$  Function – The Function  $\zeta(z)$  and  $\sigma(z)$  – The Differential Equation.

## Text Books

Ahlfors, V., "*Complex Analysis*", McGraw-Hill Education India, 3<sup>rd</sup> Edition, 2013.

**UNIT I:** Chapter 2

**UNIT II:** Chapter 4 - Section 4.1, 4.2 and 4.3

**UNIT III:** Chapter 4 - Section 5.1, 5.2, 5.3, 6.1 to 6.3

**UNIT IV:** Chapter 5 - Section 1.1 to 1.3, 2.1 to 2.4, 3.1 to 3.2

**UNIT V:** Chapter 7 – Section 2.1 to 2.4 and 3.1 to 3.3

## Reference Books

Roopkumar. R., "*Complex analysis*", Dorling Kinderley Pvt. Ltd., NewDelhi, 2015.

Ponnusamy. S., "*Foundation of Complex Analysis*", Narosa Publishing House, New Delhi, 2013.

Karunakaran, V., "*Complex Analysis*", Narosa Publishing House Pvt. Ltd. 2<sup>nd</sup> Edition, New Delhi, 2006.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Introduction to Analytic functions: Limits and Continuity - Analytic functions	4	Chalk & Talk
1.2	Polynomials - Rational functions - Elementary theory of Power series: Sequences - Series	4	E-Resources
1.3	Uniform Convergence - Power Series	2	Discussion
1.4	Abel's Limit theorem - The Exponential Functions	4	Chalk & Talk
1.5	The Trigonometric Functions - The Periodicity - The Logarithm	4	E-Resources
<b>UNIT - II</b>			
2.1	Complex Integration: Fundamental Theorems - Line Integrals, Rectifiable arcs.	3	E-Resources

2.2	Line Integrals as Functions of arcs – Cauchy’s theorem for a rectangle.	3	Discussion
2.3	Cauchy’s theorem in a disk – Cauchy’s Integral formula – Index of a point.	3	Chalk & Talk
2.4	Integral Formula – Higher derivatives – Local Properties of Analytical Functions.	3	E-Resources
2.5	Removable singularities – Taylor’s theorem – Zeros and poles.	3	Discussion
2.6	The Local mapping – The Maximum Principle.	3	Chalk & Talk
<b>UNIT – III</b>			
3.1	Complex Integration: Calculus of Residues.	4	E-Resources
3.2	Residue theorem, Argument Principle, Evaluation of definite Integrals.	6	Discussion
3.3	Harmonic Functions- Definition and Basic properties, the Mean- value Property, Poisson’s Formula.	8	Chalk & Talk
<b>UNIT – IV</b>			
4.1	Series and Product Development: Power Series Expansions: Weierstrass’s Theorem.	5	Discussion
4.2	The Taylor Series – The Laurent Series – Partial Fractions and Factorization.	5	E-Resources
4.3	Partial Fractions – Infinite Products – Canonical Products.	3	PPT
4.4	The Gamma Function – Entire functions: Jensen’s Formula – Hadamard’s theorem.	5	Chalk & Talk
<b>UNIT – V</b>			
5.1	Elliptic Functions: Doubly Periodic Functions – The Period	5	Discussion
5.2	Module – Unimodular Transformations – The Canonical Basis – The General Properties of Elliptic Functions.	6	Chalk & Talk
5.3	Weierstrass Theory – Weierstrass $p$ Function – The Function $\zeta(z)$ and $\sigma(z)$ – The Differential Equation.	7	E-Resources
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. M. Vijayasankari**

Assistant Professor of Mathematics



Course Code	Course Title	Category	Total Hours	Credits
20PMAC23	Differential Geometry	Core - VII	90	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course emphasizes concrete aspects of geometry centered on the notion of curvature.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall and Analyze knowledge in space curves	K1,K2,K3,K4
CO2	Demonstrate the metric concepts in surface	K1,K2,K3,K4,K5
CO3	Find geodesics on curves	K1,K2,K3,K4
CO4	Apply surfaces of revolution	K1,K2,K3
CO5	Evaluate principal curvature and line of curvature	K1,K2,K3,K4

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	3	3
CO2	3	3	1	2	1
CO3	2	2	2	3	3
CO4	1	3	2	3	2
CO5	3	1	1	2	3

1-Low

2-Medium

3-Strong

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	3	3
CO2	3	2	1	3	2
CO3	3	3	2	1	3
CO4	1	2	2	3	3
CO5	3	3	2	2	1

1-Low

2-Medium

3-Strong

## Syllabus

- UNIT I** 18 Hours  
The Theory of space curves: Arc length – Tangent, normal and binormal – Curvature and Torsion – The curvature and torsion of a curve as the intersection of two surfaces - Contact between curves and surfaces – Osculating circle and osculating sphere - Tangent surface, involutes and evolutes – Intrinsic equations of space curves – Fundamental existence theorem for space curves - Helices.
- UNIT II** 18 Hours  
The First Fundamental Form: Introduction – Definition of a surface – Nature of points on a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – First Fundamental form – Direction Coefficients on a surface – Families of curves – Orthogonal trajectories -Isometric correspondence – Intrinsic properties.
- UNIT III** 18 Hours  
**Geodesics on a Surface:** Introduction – Geodesic and their differential equations -Canonical geodesic equations –Geodesics on surfaces of revolution - Existence theorem – Geodesic parallels – Geodesics polar coordinates - Geodesic curvature – Gauss–Bonnet theorem
- UNIT IV** 18 Hours  
**The Second Fundamental Form and local Non-Intrinsic Properties of a Surface:** Introduction – The second fundamental form – Classification of points on a surface – Principal curvature – Lines of curvature – The Dupin indicatrix.
- UNIT V** 18 Hours  
**The Second Fundamental Form and local Non-Intrinsic Properties of a Surface:** Developable surfaces – Developables associated with associated with space curves - Developables associated with associated with curves on surfaces- Minimal surface – Ruled surface.

## Text Books

Somasundaram. D., “*Differential Geometry*,” Narosa Publishing House, Chennai, 2014.

**UNIT I:** Chapter 1 – Section- 1.4 to 1.7, 1.9 to 1.11, 1.13, 1.16 to 1.18

**UNIT II:** Chapter 2 - Section 2.1 to 2.3, 2.5 to 2.12, 2.14, 2.15

**UNIT III:** Chapter 3 - Section 3.1to 3.4, 3.7 to 3.11

**UNIT IV:** Chapter 4 - Section 4.1 to 4.6

**UNIT V:** Chapter 4 – Section 4.7 to 4.11

## Reference Books

Mittal and Agarwal, *Differential Geometry*, Krishna prakasam Publishers, Uttar Pradesh, 1998.

Willmore. T.J., *An introduction to Differential Geometry*, Oxford university press, New Delhi, 2010.

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

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	The Theory of space curves: Arc length – Tangent, normal and binormal – Curvature and Torsion	5	Chalk & Talk
1.2	The curvature and torsion of a curve as the intersection of two surfaces - Contact between curves and surfaces	5	PPT
1.3	Osculating circle and osculating sphere - Tangent surface, involutes and evolutes	3	E-Resources
1.4	Intrinsic equations of space curves – Fundamental existence theorem for space curves - Helices.	5	Chalk & Talk
<b>UNIT - II</b>			
2.1	The First Fundamental Form: Introduction – Definition of a surface	4	Discussion
2.2	Nature of points on a surface – Curves on surfaces – Tangent plane and surface normal	4	Chalk & Talk
2.3	The general surfaces of revolution – Helicoids – Metric on a surface - First Fundamental form	4	E-Resources
2.4	Direction Coefficients on a surface - Families of curves – Orthogonal trajectories	4	Discussion

2.5	Isometric correspondence - Intrinsic properties.	2	Chalk & Talk
<b>UNIT - III</b>			
3.1	Introduction - Geodesic and their differential equations	4	E-Resources
3.2	Canonical geodesic equations - Geodesics on surfaces of revolution	4	Chalk & Talk
3.3	Existence theorem - Geodesic parallels	3	Discussion
3.4	Geodesics polar coordinates	3	Chalk & Talk
3.5	Geodesic curvature	2	E-Resources
3.6	Gauss-Bonnet theorem	2	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Introduction - The second fundamental form	4	Discussion
4.2	Classification of points on a surface	5	E-Resources
4.3	Principal curvature - Lines of curvature	5	Chalk & Talk
4.4	The Dupin indicatrix.	4	Chalk & Talk
<b>UNIT - V</b>			
5.1	Developable surfaces - Developables associated with associated with space curves	8	E-Resources
5.2	Developables associated with associated with curves on surfaces	6	Chalk & Talk
5.3	Minimal surface - Ruled surface.	4	Discussion
<b>Total</b>		<b>90</b>	

**Course Designer**

**Mr. M. Vignesh Babu**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC24	Mathematical Statistics	Core -VIII	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course deals with various distributions of discrete and continuous types. Estimation of parameters and testing of hypotheses are studied in detail.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall and interpret different types of distributions	K1,K2,K3,K4
CO2	Find the limiting distribution of a sequence of random variables	K1,K2,K3,K4
CO3	Analyze and Develop statistical inferences	K1,K2,K3,K4,K5
CO4	Identify the appropriate maximum likelihood methods for a given situation and use it to estimate the parameter	K1,K2,K3,K4,K5
CO5	Demonstrate optimal testing of hypotheses	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	2	2	1	3	3
CO2	3	3	1	2	2
CO3	3	3	2	2	3
CO4	3	2	2	3	3
CO5	2	3	2	3	2

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2
CO2	1	1	1	3	3
CO3	3	3	2	3	2
CO4	2	2	2	2	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Some special distributions The Binomial and related distributions - Poisson distribution – The Gamma, Chi-square and Beta distributions – The Normal distribution – The multivariate normal distribution.

### UNIT II

18 Hours

Some special distribution, unbiasedness, consistency and limiting distribution -The t and F distributions – Expectations of functions – Convergence in probability –Convergence in distributions – Central limit theorem.

### UNIT III

18 Hours

Some elementary statistical inference, Sampling and statistics – Order statistics – More on confidence interval – Introduction to hypothesis testing – Additional comments about statistical tests.

### UNIT IV

18 Hours

Maximum likelihood methods, sufficiency: Maximum likelihood estimation – Rao cramer lower bounded efficiency – Maximum likelihood test – Measure of quality of estimators-A sufficient statistic for a parameter – Properties of a sufficient statistic.

### UNIT V

18 Hours

Optimal test of Hypotheses, Most powerful tests – Uniformly most powerful tests – Likelihood Ratio tests – The sequential probability ratio test.

## Text Books

Hogg, R.V., Craig, A.T., and Mckean, J.W., *“Introduction to Mathematical Statistics”*, Pearson Education, India, 2005.

**UNIT I:** Chapter 3 – Section- 3.1 to 3.5

**UNIT II:** Chapter 3 - Section 3.6, Chapter 4 – Section-4.1to 4.4

**UNIT III:** Chapter 5 - Section 5.1, 5.2, 5.4 to 5.6

**UNIT IV:** Chapter 6 - Section 6.1 to 6.3, Chapter 7 - Section 7.1 to 7.3

**UNIT V:** Chapter 8 – Section 8.1 to 8.4

## Reference Books

Gupta, S.C., and Kapoor, V.K., "*Mathematical Statistics*", Sultan and Chandson's publishers, New Delhi, Edition 2000.

Kapoor, J.N., and Saxena, H.C.," *Mathematical Statistics*", S. Chand & Co, New Delhi, 25<sup>th</sup> Edition, 2009.

Irwin Miller & Maryless Miller John, s., Freund, s., "*Mathematical Statistics*", Pearson Education, India, 2004.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Some special distributions The Binomial and related distributions	3	Chalk & Talk
1.2	Poisson distribution	3	E-Resources
1.3	The Gamma, Chi-square and Beta distributions,	4	Discussion
1.4	The Normal distribution	4	Chalk & Talk
1.5	The multivariate normal distribution.	4	E-Resources
<b>UNIT - II</b>			
2.1	Some special distribution, unbiasedness, consistency and limiting distribution	6	Discussion
2.2	The t and F distributions – Expectations of functions	6	Chalk & Talk
2.3	Convergence in probability –Convergence in distributions – Central limit theorem.	6	E-Resources
<b>UNIT - III</b>			
3.1	Some elementary statistical inference, Sampling and statistics	5	E-Resources
3.2	Order statistics – More on confidence interval	5	Chalk & Talk
3.3	Introduction to hypothesis testing	3	Discussion
3.4	Additional comments about statistical tests.	5	E-Resources

<b>UNIT - IV</b>			
4.1	Maximum likelihood methods, sufficiency: Maximum likelihood estimation	5	Discussion
4.2	Rao cramer lower bounded efficiency - Maximum likelihood test	4	E-Resources
4.3	Measure of quality of estimators	3	Chalk & Talk
4.4	A sufficient statistic for a parameter	3	E-Resources
4.5	Properties of a sufficient statistic.	3	Chalk & Talk
<b>UNIT - V</b>			
5.1	Optimal test of Hypotheses, Most powerful tests	6	E-Resources
5.2	Uniformly most powerful tests	4	Chalk & Talk
5.3	Likelihood Ratio tests	4	Discussion
5.4	The sequential probability ratio test.	4	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. D. Gowsalya**

Assistant Professor of Mathematics



Course Code	Course Title	Category	Total Hours	Credits
20PMAE21	Combinatorial Mathematical	Elective -II	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course deals with enumeration problems using generating functions and recurrence relation.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Provides the counting strategy to solve and analyze problems involving the combinations, distributions and combinatorial identities	K1,K2,K3,K4
C02	Explain about generating function for combinations ,Enumerators for permutations	K1,K2,K3,K4
C03	Determine the recurrence relations and solve with generating functions	K1,K2,K3,K4,K5
C04	Demonstrate inclusion-exclusion Principle.	K1,K2,K3,K4,K5
C05	Recall Polya's formula and solve enumeration problems	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	1	2	3
C02	2	1	3	3	2
C03	3	3	2	1	3
C04	3	3	2	3	3
C05	2	3	2	2	2

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	3
CO2	3	3	1	3	3
CO3	2	3	2	3	2
CO4	3	2	2	2	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Introduction – the rules of sum and product – permutations – combinations – distribution of distinct objects – distributions of non – distinct objects.

### UNIT II

18 Hours

Introduction – Generating functions for combinations – Enumerators for permutation – distributions of distinct objects into non – distinct cells – partitions of integer – elementary relations.

### UNIT III

18 Hours

Introduction – Linear recurrence relations with constant coefficients – solution by the technique of generating functions – recurrence relations with two indices.

### UNIT IV

18 Hours

Introduction – The principle of inclusion and exclusion – the general formula – derangements.

### UNIT V

18 Hours

Introduction – Equivalence classes under permutation group – equivalence classes of functions – weight and inventories of functions – Polya's fundamental theorem – generalizations of Polya's theorem.

## Text Books

Liu, C.T., "*Introduction to combinatorial Mathematics*", McGraw Hill, 1968.

**UNIT I:** Chapter 1 – Section-1.1 to 1.6

**UNIT II:** Chapter 2 - Section 2.1 to 2.5 and 2.7

**UNIT III:** Chapter 3 - Section 3.1 to 3.3 and 3.5

**UNIT IV:** Chapter 4 - Section 4.1 to 4.4

**UNIT V:** Chapter 5 – Section 5.1, 5.3 to 5.7

## Reference Books

Richard Brualdi, A., “ *Introductory Combinatorics*”, Pearson Education Inc, Asia Limited and China Machine Press, 5<sup>th</sup> Edition, 2010.

Krishnamurthy, V., “ *Combinatorics - Theory and Applications*”, East-West Press, New Delhi, 2000.

Peter J. Cameron,” *Combinatorics: Topics, Techniques, Algorithms*”, Cambridge University Press, United Kingdom, 1<sup>st</sup> Edition, 1995.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Introduction	2	Discussion
1.2	The rules of sum and product	3	E-Resources
1.3	permutations	3	Chalk & Talk
1.4	combinations	3	E-Resources
1.5	Distribution of distinct objects	3	Chalk & Talk
1.6	Distributions of non – distinct objects.	4	E-Resources
<b>UNIT - II</b>			
2.1	Introduction	2	Chalk & Talk
2.2	Generating functions for combinations	3	Chalk & Talk
2.3	Enumerators for permutation	3	Chalk & Talk
2.4	distributions of distinct objects into non – distinct cells	4	E-Resources
2.5	partitions of integer	3	Chalk & Talk
2.6	elementary relations	3	E-Resources
<b>UNIT - III</b>			
3.1	Introduction	2	Chalk & Talk
3.2	– Linear recurrence relations with constant coefficients	6	E-Resources
3.3	Solution by the technique of generating n functions	6	Chalk & Talk
3.4	Recurrence relations with two indices	4	E-Resources

<b>UNIT - IV</b>			
4.1	Introduction	4	Chalk & Talk
4.2	The principle of inclusion and exclusion	5	E-Resources
4.3	The general formula	5	Discussion
4.4	derangements,	4	Chalk & Talk
<b>UNIT - V</b>			
5.1	Introduction	2	E-Resources
5.2	Equivalence classes under permutation group	4	Chalk & Talk
5.3	Equivalence classes of function	3	Chalk & Talk
5.4	Weight and inventories of functions	3	E-Resources
5.5	Polya's fundamental theorem	3	Discussion
5.6	Generalizations of Polya's theorem	3	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. M. Vijayasankari**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAE22	Fuzzy sets & Logics	Elective - II	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

## Preamble

Fuzzy sets and Fuzzy logic introduce the concept of uncertainty and fuzziness and deals with the applications in fuzzy systems and fuzzy decision.

## Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Define and illustrate the concept of fuzzy sets and crisp sets	K1,K2,K3,K4
CO2	Analyze the axioms and build operations on fuzzy sets	K1,K2,K3
CO3	Explain a brief introduction to fuzzy arithmetic concept	K1,K2,K3,K4
CO4	Compare the differences and similarities between Fuzzy sets and classical set theories	K1,K2,K3,K4,K5
CO5	Apply rules of inference and infer from various types of fuzzy propositions	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

## Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	3	2
CO2	2	3	1	3	3
CO3	3	3	2	2	1
CO4	2	1	1	3	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	3	3
CO2	3	3	1	3	3
CO3	1	2	2	2	2
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

- UNIT I** 18 Hours  
Fuzzy sets – Basic types – Fuzzy sets – Basic concepts – Additional properties of  $\alpha$ -cuts – Representation of fuzzy sets.
- UNIT II** 18 Hours  
Extension principle for fuzzy sets – Types of Operations – Fuzzy Complements – Fuzzy numbers.
- UNIT III** 18 Hours  
Linguistic variables – arithmetic operations on intervals – arithmetic operations on fuzzy numbers.
- UNIT IV** 18 Hours  
Fuzzy relation – Crisp versus fuzzy relations – projection and cylindric extensions - Binary fuzzy relations on a single set – Fuzzy equivalence relations.
- UNIT V** 18 Hours  
Fuzzy logic – Classical logic-An overview – multivalued logic – Fuzzy propositions - Fuzzy quantifiers – Linguistic Hedges – Inference from conditional fuzzy propositions. Inference from quantifier propositions.

## Text Books

George Klir, J., and Yuan , B., "*Fuzzy sets and Fuzzy logic – Theory and applications*".

**UNIT I:** Chapter 1 – Section-1.3,1.4, Chapter 2 – Section - 2.1,2.2

**UNIT II:** Chapter 2 - Section 2.3, Chapter 3 – Section -3.1, 3.2,  
Chapter 4 -Section- 4.1

**UNIT III:** Chapter 4 - Section 4.2, 4.3 and 4.4

**UNIT IV:** Chapter 5 - Section 5.1 to 5.5

**UNIT V:** Chapter 8 – Section 8.1 to 8.6

## Reference Books

Ganesh, M., “ *Introduction to Fuzzy Sets and Fuzzy Logic*”, Prentice-Hall of India, 2015, Hung Nguyen, T., and Elbert Walker, A.,” *A First Course in Fuzzy Logic* “, Chapman and Hall/CRC. India, 2006,  
Zimmermann, H.J. “*Fuzzy Set Theory and its Applications*” Allied Publishers Ltd., Chennai, 1996.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Fuzzy sets Basic types	4	E-Resources
1.2	Fuzzy sets Basic concepts	5	Chalk & Talk
1.3	Additional properties of $\alpha$ -cuts	4	Chalk & Talk
1.4	Representation of fuzzy sets.	5	E-Resources
<b>UNIT - II</b>			
2.1	Extension principle for fuzzy sets	4	Chalk & Talk
2.2	Types of Operations	4	E-Resources
2.3	Fuzzy Complements	5	Discussion
2.4	Fuzzy numbers	5	Chalk & Talk
<b>UNIT - III</b>			
3.1	Linguistic variables	5	Chalk & Talk
3.2	arithmetic operations on intervals	6	Chalk & Talk
3.3	arithmetic operations on fuzzy numbers	7	E-Resources
<b>UNIT - IV</b>			
4.1	Fuzzy relation	3	Discussion
4.2	Crisp versus fuzzy relations	3	E-Resources
4.3	projection and cylindric extensions	4	Chalk and Talk
4.4	Binary fuzzy relations on a single set	4	Chalk and Talk
4.5	Fuzzy equivalence relations	4	Discussion

UNIT - V			
5.1	Fuzzy logic – Classical logic	3	E-Resources
5.2	An overview multivalued logic	3	Chalk & Talk
5.3	Fuzzy propositions	3	Discussion
5.4	Fuzzy quantifiers	2	Chalk & Talk
5.5	Linguistic Hedges	3	Chalk & Talk
5.6	Inference from conditional fuzzy propositions.	4	E-Resources
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. D. Gowsalya**

Assistant Professor of Mathematics



Course Code	Course Title	Category	Total Hours	Credits
20PMAC31	Field Theory & Lattices	Core - IX	105	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

### Preamble

The Course deals with methods of finding roots of a polynomial over a field in its extension the constructible real numbers are discussed. The four-square theorem is proved using the properties of finite fields.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall and construct extension of a given field Explain the fundamental concepts of field extensions.	K1,K2,K3,K4
CO2	Construct a polygon using just a compass and a ruler.	K1,K2,K3,K4
CO3	Explain the concept of Galois Theory and the related results.	K1,K2,K3,K4
CO4	Analyze the theorems on finite division rings	K1,K2,K3,K4,K5
CO5	Explain the properties of Lattice Theory.	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	2	3	1	2	3
CO2	3	3	1	3	3
CO3	2	3	3	1	3
CO4	3	3	2	3	2
CO5	3	1	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	2	3	1	2	3
CO3	3	2	2	3	3
CO4	3	3	2	3	2
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

- UNIT I** 21 Hours  
Fields Extension Fields - The Transcendence of  $e$ . Roots of Polynomials - Construction with Straightedge and Compass –More About Roots.
- UNIT II** 21 Hours  
The Elements of Galois Theory - Solvability by Radicals.
- UNIT III** 21 Hours  
Galois Groups over the Rationals Selected Topics Finite Fields Wedderburn's Theorem on Finite Division Rings
- UNIT IV** 21 Hours  
Lattices- partially ordered Sets-Modular lattices-Schreier's theorem.
- UNIT V** 21 Hours  
Decomposition theory for lattices with ascending chain Condition- Independence – complemented lattices – Boolean algebra.

## Text Books

- Herstein, I. N. "*Topics in Algebra*", John Wiley and Sons, Reprint 2016.
- Gabor Szasz . *Introduction to Lattice Theory*, Third Revised and Enlarged Edition, Academic Press, New York and London.
- Nathan Jacobson, "*lectures in Abstract Algebra*", Affiliated East-West Press Pvt. Ltd 1971

**Unit I:** Book -1: Chapter5 –Section-5.1, 5.5

**Unit II:** Book-1: Chapter 5 - Section – 5.6, 5.7

**Unit III:** Book -3 Chapter 5 – Section- 5.87, chapter 7- section- 7.1 – 7.2

**Unit IV:** Book -3 Chapter 7 Section 7.3 to 7.4

**Unit V:** Book -3 Chapter 7 Section 7.5 to 7.8

## Reference Books

- John, B. Fraleigh ., *A First Course in Abstract Algebra*, 3<sup>rd</sup> Edition, Narosa Publications, Eighth Reprint, 1996.
- Joseph Gallian. A., *Contemporary Abstract Algebra*, 8<sup>th</sup> Edition BROOKS COLE, Cengage Learning, 2013.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Fields Extension Fields	10	Chalk & Talk
1.2	The Transcendence of e	11	E-Resources
<b>UNIT - II</b>			
2.1	Roots of Polynomials	8	Discussion
2.2	Construction with Straight edge and Compass - More About Roots.	13	Chalk & Talk
<b>UNIT - III</b>			
3.1	The Elements of Galois Theory	10	E-Resources
3.2	Solvability by Radicals	11	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Galois Groups over the Rationals	7	Discussion
4.2	Finite Fields Wedderburn's Theorem	7	E-Resources
4.3	Theorem on Finite Division Rings.	7	Chalk & Talk
<b>UNIT - V</b>			
5.1	Lattices in General- Lattices-The lattice theoretical duality principle	7	Chalk & Talk
5.2	Semi lattices- Lattices as partly ordered sets - Diagrams of lattices, Ideals	7	E-Resources
5.3	Bound elements of a lattice, Atoms and dual atoms - Complements, relative Complements, semi complements.	7	Discussion
<b>Total</b>		<b>105</b>	

## Course Designer

**Ms. D. Gowsalya**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC32	Measure Theory	Core - X	105	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course deals with Lebesgue measure, Lebesgue integral on bounded sets, General measure spaces and Decomposition theorems

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Apply the knowledge gained from concrete cases to a general situation by means of going to general measure starting from Lebesgue measure.	K1,K2,K3,K4,K5
CO2	Utilize constructive type proof technique effectively.	K1,K2,K3,K4
CO3	Move sequentially from basic case to required case via all possible in between cases while introducing integration for general functions via simple functions.	K1,K2,K3,K4
CO4	Construct with new functions such as functions of bounded variations an absolutely continuous function.	K1,K2,K3,K4
CO5	Summarize the necessity of checking the existence and uniqueness whenever they come across such a situation.	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	2	1	3	3
CO2	3	2	3	3	3
CO3	2	3	3	1	2
CO4	3	3	2	3	2
CO5	2	1	2	1	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	2	3
CO2	2	3	3	2	3
CO3	3	2	2	3	2
CO4	2	3	2	3	2
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

21 Hours

Lebesgue Measure Introduction -Outer measure - Measurable sets and Lebesgue measure – A non-measurable set – Measurable functions- Little wood's three principles.

### UNIT II

21 Hours

The Lebesgue Integral the Riemann Integral –Lebesgue integral of a bounded function over a set of finite measure-The integral of a nonnegative function - The general Lebesgue integral.

### UNIT III

21 Hours

Differentiation and Integration - Differentiation of monotone functions- Functions of bounded variation- Differentiation of an integral – Absolute continuity.

### UNIT IV

21 Hours

Measure and Integration Measure spaces - Measurable functions – Integration-General convergence theorems-Signed measures – The Radon-Nikodym theorem.

### UNIT V

21 Hours

Measure and Outer Measure Outer measure and measurability - The extension theorem - Product measures.

## Text Books

Royden. H.L., *“Real Analysis”*, III Edition, Prentice-Hall of India Pvt. Ltd., 2009.

**Unit I:** Chapter 3- Section 1-6

**Unit II:** Chapter 4-Section 1-4

**Unit III:** Chapter 5-Section 1-41-4

**Unit IV:** Chapter 11-Section 1-6

**Unit V:** Chapter 12 -Section 1, 2, 4

## Reference Books

De Barra. G. *Measure Theory and Integration*, New Age International Publishers, 2009.

Paul R. Halmos, *Measure Theory*, Narosa Publishing House New Delhi, Springer International Student Ed., 1981.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Lebesgue Measure Introduction	3	Chalk & Talk
1.2	Outer measure	4	E-Resources
1.3	Measurable sets and Lebesgue measure	4	Discussion
1.4	A non-measurable set	3	Chalk & Talk
1.5	Measurable functions	3	E-Resources
1.6	Little wood's three principles	4	Discussion
<b>UNIT - II</b>			
2.1	The Lebesgue Integral The Riemann Integral	5	E-Resources
2.2	Lebesgue integral of a bounded function over a set of finite measure	6	Discussion
2.3	The integral of a nonnegative function	5	Chalk & Talk
2.4	The general Lebesgue integral	5	E-Resources
<b>UNIT - III</b>			
3.1	Differentiation and Integration	4	E-Resources
3.2	Differentiation of monotone functions	4	Discussion
3.3	Functions of bounded variation	4	Chalk & Talk
3.4	Differentiation of an integral	5	Chalk & Talk
3.5	Absolute continuity	4	E-Resources
<b>UNIT - IV</b>			
4.1	Measure and Integration Measure spaces	3	PPT
4.2	Measurable functions	4	PPT

4.3	Integration	4	PPT
4.4	General convergence theorems	3	Chalk & Talk
4.5	Signed measures	3	E-Resources
4.6	The Radon-Nikodym theorem	4	Discussion
<b>UNIT - V</b>			
5.1	Measure and Outer Measure Outer measure and measurability	7	E-Resources
5.2	The extension theorem	7	Chalk & Talk
5.3	Product measures	7	Discussion
<b>Total</b>		<b>105</b>	

**Course Designer**

**Ms. A. Benazir**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC33	Mathematical Methods	Core - XI	105	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

Basic Knowledge in Calculus and Differential equations.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Understand and Apply Various transforms and Integral equations to solve problems in all respects.	K1,K2,K3,K4
CO2	Recognize and Solve the special cases of Volterra integral equations by the method of resolvent kernel method of successive approximations and by using transforms.	K1,K2,K3,K4,K5
CO3	Understand the relations between the Hankel, Fourier transforms and their applications in evaluating the equations.	K1,K2,K3,K4
CO4	Understand the formulation of variational problems, the variation of functional and its properties.	K1,K2,K3,K4,K5
CO5	Demonstrate and apply the methods in all application problems in day-today life.	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	2	2	3
CO2	3	3	2	1	3
CO3	2	3	3	1	3
CO4	3	2	2	3	2
CO5	2	2	1	3	3

1-Low

2-Medium

3-Strong



## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	2	2	1	2	3
CO3	3	2	2	3	3
CO4	3	3	3	1	2
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

21 Hours

Fourier Transforms – Definition - Inversion theorem - Fourier cosine transforms-Fourier sine transforms- Fourier transforms of derivatives-Fourier transforms of some simple functions- Fourier transforms of rational functions-The convolution integral-convolution theorem- Parseval's relation for Fourier transforms-Solution of PDE by Fourier transforms Laplace's equation in Half plane Laplace's Equation in an infinite strip - The Linear diffusion equation on a semi-infinite line The two dimensional diffusion equation

### UNIT II

21 Hours

Definition-Elementary properties of Hankel transform- Hankel transforms of derivatives of Functions- Hankel transforms of some elementary Functions-The Parseval's relation for Hankel Transforms-Relation between Fourier and Hankel Transforms-Application of PDE- Axisymmetric Dirichlet Problem for a half space- Axisymmetric Dirichlet Problem for a thick plate.

### UNIT III

21 Hours

Types of integral equations-Equation with separable kernel-Fredholm Alternative Approximate method- Volterra integral equations-Classical Fredholm theory-Fredholm's First Second Third theorem.

### UNIT IV

21 Hours

Initial value problems- Boundary value problems-Single integral equations- Abel integral equations.

### UNIT V

21 Hours

Variation and its properties-Eulers equations-Functional's of the integral forms- Functional dependent on higher order derivatives-Functional dependent on the function of several independent variables-Variational problems in parametric forms.

## Text Books

Sneddon. I. N., "*The use of Integral Transforms*", Tata Mc Graw Hill, New Delhi 1974.

Kanwal.R.P., "*Linear Integral Equations Theory and Technique*", Academic press Newyork ,1971.

Elsgolts.L., "*Differential Equations and Calculus of variations*" Mir Publishers, Moscow 1970.

**Unit I & Unit II:** Book -1

**Unit III & Unit IV:** Book -2

**Unit V:** Book -3

## Reference Books

Lokenath Debnath Bhatta., "*Integral transforms and their applications*" Taylor and francis London 2007.

Corduneanu.C "*Integral equation and applications*" Cambridge University press 1991.

Weinstock.R., "*Calculus of variations with applications to physics & Engineering*" Mc Graw Hill, Newyork 1952.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Fourier cosine transforms-Fourier sine transforms	3	Chalk & Talk
1.2	Fourier transforms of derivatives- Fourier transforms of some simple functions	4	PPT
1.3	Fourier transforms of rational Functions- The convolution integral-convolution theorem	4	E-Resources
1.4	Parseval's relation for Fourier transforms- Solution of PDE by Fourier transforms	3	Chalk & Talk
1.5	Laplace's equation in Half plane Laplace's Equation in an infinite strip	3	PPT
1.6	The Linear diffusion equation on a semi Infinite line The two dimensional diffusion equation.	4	E-Resources

<b>UNIT - II</b>			
2.1	Elementary properties of Hankel transform - Hankel transforms of derivatives of Functions - Hankel transforms of some elementary Functions	6	Discussion
2.2	The Parseval's relation for Hankel transforms-Relation between Fourier and Hankel transforms	6	Chalk & Talk
2.3	Axisymmetric Dirichlet Problem for a half space	4	E-Resources
2.4	Axisymmetric Dirichlet Problem for a thick plate.	5	Discussion
<b>UNIT - III</b>			
3.1	Types of integral equations	4	E-Resources
3.2	Equation with separable kernel	4	Chalk & Talk
3.3	Fredholm Alternative Approximate method	4	Discussion
3.4	Volterra integral equations-Classical Fredholm theory	5	Chalk & Talk
3.5	Fredholm's First Second Third theorem.	4	E-Resources
<b>UNIT - IV</b>			
4.1	Initial value problems	7	Discussion
4.2	Boundary value problems-Single integral equations	7	E-Resources
4.3	Abel integral equations.	7	Chalk & Talk
<b>UNIT - V</b>			
5.1	Variation and its properties - Eulers equations - Functional's of the integral forms	7	E-Resources
5.2	Functional dependent on higher order derivatives-Functional dependent on the function of several independent variables	7	Chalk & Talk
5.3	Variational problems in parametric forms.	7	Discussion
<b>Total</b>		<b>105</b>	

**Course Designer**

**Mr. M. Vignesh Babu**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAE31	Number Theory	Elective -III	90	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

### Preamble

The course provides the basic concepts of Numbers such as Divisibility, Congruences, Quadratic residues and some arithmetic functions.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Classify in the theory of integer from the list of axioms and explore some research problem in number theory.	K1,K2,K3,K4
CO2	Solve problems in Number Theory.	K1,K2,K3,K4
CO3	Find the greatest common divisor using the Euclidean algorithm.	K1,K2,K3,K4
CO4	Recognize various arithmetical functions. -solve systems of linear congruence's	K1,K2,K3,K4,K5
CO5	Analyze & Explain reciprocity law	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	2	2	2	3	3
CO2	3	2	3	2	3
CO3	3	1	3	1	3
CO4	3	2	3	3	2
CO5	2	2	2	2	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	2	2	3	3	3
CO3	3	2	3	3	2
CO4	2	3	3	2	3
CO5	3	3	2	2	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Introduction, divisibility, Greatest Common divisor, prime numbers, the fundamental theorem of arithmetic. The series of reciprocals of the primes. The Euclidean algorithm, the GCD of more than two numbers, the Mobius function, the Euler totient function, a relation connecting  $\mu$  and  $\phi$ , A product formula for  $\phi(n)$ . The Dirichlet product of arithmetical functions, Dirichlet inverses and the Mobius inversion formula, the Mangoldt function, Multiplicative functions, multiplicative functions and Dirichlet multiplication principles.

### UNIT II

18 Hours

Liouville's functions, the divisor function. The Bell series of an arithmetical function generalized convolutions, Formal Power series. The bell series and Dirichlet multiplication. Derivatives of arithmetic function. The Selberg identity, big oh notation, Asymptotic equality of functions Euler's summation formula, some elementary asymptotic formulas. The average order of  $d(n)$ , the average order of the divisor functions  $\sigma_\alpha(n)$ , the average order of  $\phi(n)$ . An application to the distribution of lattice points visible from the origin, the average order of  $\sigma_\alpha(n)$  and  $\wedge(n)$ , the partial sums of a Dirichlet product. Application to  $\mu(n)$  and  $\wedge(n)$ , another identity for the partial sums of a Dirichlet product.

### UNIT III

18 Hours

Introduction to Chebyshev's function - Definition, basic properties of congruences, residue classes and complete residue system, Linear congruences, reduced residue system and the Euler - Fermat theorem. Polynomial congruences modulo  $p$ , Lagrange's theorem, application of Lagrange's theorem.

**UNIT IV**

18 Hours

Simultaneous linear congruences. The Chinese remainder theorem. Applications of Chinese remainder theorem. Polynomial congruences with prime power moduli. The principle of cross classification. A decomposition property of reduced residue systems, Quadratic residues, Legendre's symbol and its properties, Evaluation of  $(-1/p)$  and  $(2/p)$  Gauss Lemma.

**UNIT V**

18 Hours

The quadratic reciprocity Law, application of the quadratic reciprocity law, the Jacobi Symbol. Gauss Sums and the quadratic reciprocity law. The reciprocity law for quadratic Gauss Sums.

**Text Books**

Apostol. T. M "*Introduction to Analytic Number Theory*"

**UNIT - I:** Chapter 1-section 1.1-1.8 and chapter 2 - section 2.1 -2.10

**UNIT - II:** Chapter 2-section 2.1-2.19 and chapter 3 - section 3.1 -3.12

**UNIT -III:** Chapter 4-section 4.1-4.2 and chapter 5 - section 5.1 -5.6

**UNIT - IV:** Chapter 5-section 5.7-5.11 and chapter 9 - section 9.1 -9.4

**UNIT -V:** Chapter 9-section 9.5-9.10

**Reference Books**

Niven and Zuckerm "*Introduction to the theory of Numbers*"

David Burton.M" *Elementry Number Theory*"

**Pedagogy**

Chalk & Talk, E-Resources, Group Discussion

**Teaching aids**

Black Board, LCD Projector

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Introduction, divisibility, Greatest Common divisor, prime numbers, the fundamental t theorem of arithmetic.	4	Discussion
1.2	The series of reciprocals of the primes. The Euclidean algorithm.	3	E-Resources

1.3	the GCD of more than two numbers, the Mobius function, the Euler totient function, a relation connecting $\mu$ and $\phi$ , A product formula for $\phi(n)$ .	4	Chalk & Talk
1.4	The Dirichlet product of arithmetical functions, Dirichlet inverses and the Mobius inversion formula, the Mangoldt function, Multiplicative functions.	4	E-Resources
1.5	Multiplicative functions and Dirichlet multiplication principles.	3	Chalk & Talk
<b>UNIT - II</b>			
2.1	Liouville's functions, the divisor function. The Bell series of an arithmetical function generalized convolutions, Formal Power series. The bell series and Dirichlet multiplication.	4	Chalk & Talk
2.2	Derivatives of arithmetic function. The selberg identity, big oh notation, Asymptotic equality of functions Euler's summation formula, some elementary asymptotic formulas.	4	E-Resources
2.3	The average order of $d(n)$ , the average order of the divisor functions $\sigma_\alpha(n)$ , the average order of $\phi(n)$ .	3	Discussion
2.4	An application to the distribution of lattice points visible from the origin, the average order of $\sigma_\alpha(n)$ and $\wedge(n)$ , the partial sums of a Dirichlet product.	4	Chalk & Talk
2.5	Application to $\mu(n)$ and $\wedge(n)$ , another identity for the partial sums of a Dirichlet product.	3	E-Resources
<b>UNIT - III</b>			
3.1	Introduction to Chebyshev's function - Definition, basic properties of congruences, residue classes and complete residue system.	7	Chalk & Talk
3.2	Linear congruences, reduced residue system and the Euler - Fermat theorem.	5	E-Resources

3.3	Polynomial congruences modulo $p$ , Lagrange's theorem, application of Lagrange's theorem.	6	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Simultaneous linear congruences. The Chinese remainder theorem. Applications of Chinese remainder theorem.	5	Chalk & Talk
4.2	Polynomial congruences with prime power moduli. The principle of cross classification.	5	E-Resources
4.3	A decomposition property of reduced residue systems, Quadratic residues, Legendre's symbol and its properties, Evaluation of $(-1/p)$ and $(2/p)$ Gauss Lemma.	8	Discussion
<b>UNIT - V</b>			
5.1	The quadratic reciprocity Law, application of the quadratic reciprocity law, the Jacobi Symbol.	9	E-Resources
5.2	Gauss Sums and the quadratic reciprocity law. The reciprocity law for quadratic Gauss Sums.	9	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. D. Gowsalya**

Assistant Professor of Mathematics



Course Code	Course Title	Category	Total Hours	Credits
20PMAE32	Cryptography	Elective -III	90	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

To provide a thorough knowledge about the cryptography and network security.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall the fundamentals of cryptography	K1
CO2	Demonstrate standard cryptographic algorithms used to analyze confidentiality, integrity and authenticity.	K1,K2,K3,K4
CO3	List and Identify the security issues in the network, key distribution and management schemes	K1,K2,K3
CO4	Explain in detail about Data encryption standard (DES) Structure	K1,K2
CO5	Analyze the Advanced Encryption standard (AES)	K1,K2,K3,K4

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	2	1	3	3
CO2	2	3	3	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	2	1	2	1	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	2	32
CO2	2	2	2	2	3
CO3	3	2	2	3	2
CO4	3	3	2	2	2
CO5	3	3	2	3	2

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Introduction: Security goals – Cryptographic attacks – Services and mechanism – Techniques. Mathematics of Cryptography: Integer arithmetic – Modular arithmetic – Matrices– Linear congruence. Principles.

### UNIT II

18 Hours

Traditional symmetric –Key ciphers: Introduction–Substitution ciphers– Transposition ciphers – Stream and block ciphers.

### UNIT III

18 Hours

Mathematics of symmetric – Key cryptography: Algebraic structures – GF ( $2n$ ) Fields Introduction to modern symmetric – Key ciphers: Modern block ciphers – Modern stream ciphers.

### UNIT IV

18 Hours

Data Encryption Standard (DES): Introduction – DES structure – DES analysis –Security of DES – Multiple DES (Conventional Encryption Algorithms) – Examples of block ciphers influenced by DES.

### UNIT V

18 Hours

Advanced Encryption Standard (AES): Introduction – Transformations – Key expansion – The AES Ciphers – Examples – Analysis of AES.

## Text Books

Behrouz Forouzan A and Debdeep Mukhopadhyay, "*Cryptography and Network Security*" McGraw Hill Education (India) Private Limited New Delhi, 2<sup>nd</sup> Edition, 2013.

**Unit I :** Chapter1-Section-1.1-1.4, Chapter 2-Section-2.1-2.4

**Unit II:** Chapter -3-Section-3.1-3.4

**Unit III:** Chapter -4-Section-4.1-4.2, Chapter5, Section-5.1- 5.2

**Unit IV:** Chapter- 6-Section-6.1-6.6

**Unit V:** Chapter -7-Section-7.1-7.6

## Reference Books

Atul Kahate, "*Cryptography and Network Security*" McGraw Hill Education(India) Private Limited, New Delhi, Third Edition, 2014.

Bruce Schneier, "*Applied Cryptography: Protocols, Algorithms and Source code in C*", Wiley India New Delhi, 2<sup>nd</sup> Edition, 2012.

Stallings, "*Cryptography and Network Security*,": Principles and Practice, Pearson Education, New Delhi, India, Sixth Edition, 2013,.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Introduction: Security goals - Cryptographic attacks	6	Discussion
1.2	Services and mechanism - Techniques. Mathematics of Cryptography: Integer arithmetic	6	E-Resources
1.3	Modular arithmetic - Matrices- Linear congruence. Principles.	6	Chalk & Talk
<b>UNIT - II</b>			
2.1	Traditional symmetric - Key ciphers	4	Chalk & Talk
2.2	Introduction-Substitution ciphers	5	E-Resources
2.3	Transposition ciphers	5	Discussion
2.4	Stream and block ciphers.	4	Chalk & Talk
<b>UNIT - III</b>			
3.1	Mathematics of symmetric - Key cryptography	6	Chalk & Talk
3.2	Algebraic structures - GF (2 <sup>n</sup> ) Fields Introduction to modern	6	E-Resources

3.3	Symmetric – Key ciphers: Modern block ciphers – Modern stream ciphers.	6	Chalk & Talk
<b>UNIT – IV</b>			
4.1	Data Encryption Standard (DES): Introduction – DES structure	5	Chalk & Talk
4.2	DES analysis –Security of DES – Multiple DES (Conventional Encryption Algorithms)	8	E-Resources
4.3	Examples of block ciphers influenced by DES.	5	Discussion
<b>UNIT – V</b>			
5.1	Advanced Encryption Standard (AES): Introduction – Transformations	9	E-Resources
5.2	Key expansion – The AES Ciphers – Examples – Analysis of AES.	9	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Ms. M. Vijayasankari**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC41	Topology	Core - XII	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

Topology developed as a field of study out of geometry and set theory, through analysis of concepts as space, dimension, and transformation the course emphasize an introduction to theory of topological spaces and focus on selected types of topological spaces.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall and construct various topologies on Sets and compare them	K1,K2,K3
CO2	Define basic and make use of bases to generate topology and justify Connectedness in topological spaces	K1,K2,K3,K4,K5
CO3	Classify and analyze the nature of compact Topological spaces in particular on Real line	K1,K2,K3,K4
CO4	Define and Categorize separation axioms on different topological spaces	K1,K2,K3,K4
CO5	Interpret and extend the metrizable concepts of topological spaces	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	3	1
CO2	3	3	1	2	3
CO3	2	3	2	3	2
CO4	3	2	2	1	3
CO5	3	3	2	3	1

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	2
CO2	2	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	3
CO5	2	1	3	2	2

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Topological spaces – Basis for a topology – the order topology – the product topology on  $X \times Y$ . The sub space topology – closed sets and limit Points – continuous functions – the product topology.

### UNIT II

18 Hours

The Metric topology–connected spaces–connected spaces on a real line.

### UNIT III

18 Hours

Compact spaces – compact sub spaces of the real line – Limit point compactness – Local compactness.

### UNIT IV

18 Hours

Countability axioms – the separation axioms–normal spaces.

### UNIT V

18 Hours

The Urysohn Lemma – the Urysohn Metrization theorem–Tietze extension theorem The Tychonoff theorem.

## Text Books

Munkres, James R., "*Topology*", Prentice-Hall of India Private Ltd., NewDelhi, 2<sup>nd</sup> Edition.

**UNIT I:** chapter-2 -sections: 12-19

**UNIT II:** chapter-2 -sections20 and chapter-3-sections: 23,24

**UNIT III:** chapter-3- sections26 -29

**UNIT IV:** chapter-4- sections30 -32

**UNIT V:** chapter-4- sections 33-35 and chapter5sections 37

## Reference Books

Chandra sekhar Rao, K., "*Topology*", Narosa Publishing House, NewDelhi, 2012.  
Chatterjee, D., "*Topology General & Algebraic*", New Age International. Chennai, 2007.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Topological spaces - Basis for a topology	1	Chalk & Talk
1.2	The order topology - The product topology on $X \times Y$ .	2	E-Resources
1.3	The subspace topology - Closed sets and limit Points.	3	Discussion
1.4	Continuous functions - The product topology.	4	Chalk & Talk
<b>UNIT - II</b>			
2.1	The Metric topology	5	Discussion
2.2	Connected spaces	6	Chalk & Talk
2.3	Connected spaces on a real line.	7	E-Resources
<b>UNIT - III</b>			
3.1	Compact spaces	3	E-Resources
3.2	Compact subspaces of their real line	5	Chalk & Talk
3.3	Limit point compactness	5	Discussion
3.4	Local compactness	5	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Countability axioms	6	Discussion
4.2	The separation axioms	6	E-Resources
4.3	Normal spaces.	6	Chalk & Talk
<b>UNIT - V</b>			
5.1	The Urysohn Lemma	3	E-Resources
5.2	The Urysohn Metrization theorem	5	Chalk & Talk
5.3	Tietze extension theorem	5	Discussion
5.4	The Tychonoff theorem.	5	Chalk & Talk
<b>Total</b>		<b>90</b>	

## Course Designer

**Ms. M. Vijayasankari**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC42	Functional Analysis	Core - XIII	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

### Preamble

The course provides a firm grounding in the theory and techniques of functional Analysis.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Develop the skills in analyzing the basic structure of Banach spaces	K1,K2,K3
CO2	Recall the results in Banach space and Hilbert spaces	K1,K2,K3,K4
CO3	Apply Normed space theory to prove Hahn-Banach theorem	K1,K2,K3,K4
CO4	Demonstrate the fundamentals of functional analysis	K1,K2,K3,K4,K5
CO5	Explain the operators and find the spectrum of operators	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	2	3	3	2
CO2	3	2	2	3	2
CO3	3	2	3	3	2
CO4	3	2	3	3	3
CO5	3	2	3	3	3

1-Low

2-Medium

3-Strong



## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	3	2	1	3	2
CO3	3	2	2	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

1-Low

2-Medium

3-Strong

## Syllabus

- UNIT I** 18 Hours  
Banach spaces: Definition and examples – Continuous Linear transformations – The Hahn Banach theorem.
- UNIT II** 18 Hours  
The Natural Imbedding of  $N$  in  $N^{**}$  - The open mapping theorem – The Conjugate of an operator.
- UNIT III** 18 Hours  
Hilbert Spaces: The definition and some simple properties –orthogonal complements – Ortho normal sets–The conjugate space  $H^*$ .
- UNIT IV** 18 Hours  
The adjoint of an operator – Self adjoint operators – Normal and Unitary operators – Projections.
- UNIT V** 18 Hours  
Finite Dimensional Spectral Theory-Matrices –Determinants and the spectrum of an operator– The spectral theorem.

## Text Books

Simmons, G.F., *“Introduction to Topology and Modern Analysis”*, Tata McGraw Hill.

**UNIT I:** chapter -9 -sections: 46 -48

**UNIT II:** chapter- 9-sections49-51

**UNIT III:** chapter-10 -sections 52-55

**UNIT IV:** chapter-10 -sections56-59

**UNIT V:** chapter-10-sections60-62

## Reference Books

Limaye.B.V., *“Functional Analysis”*, Newage international(P)Ltd, NewDelhi,2002.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Banach spaces: Definition and examples	6	Chalk & Talk
1.2	Continuous Linear transformations	6	E-Resources
1.3	The Hahn Banach theorem.	6	Discussion
<b>UNIT - II</b>			
2.1	The Natural Imbedding of $N$ in $N^{**}$	6	Discussion
2.2	The open mapping theorem	6	Chalk & Talk
2.3	The Conjugate of an operator.	6	E-Resources
<b>UNIT - III</b>			
3.1	Hilbert Spaces :The definition and some simple properties	6	E-Resources
3.2	Orthogonal complements	6	Chalk & Talk
3.3	Ortho normal sets	6	Discussion
<b>UNIT - IV</b>			
4.1	The adjoint of an operator	4	Discussion
4.2	Self adjoint operators	4	E-Resources
4.3	Normal and Unitary operators	5	Chalk & Talk
4.4	Projections	5	Chalk & Talk
<b>UNIT - V</b>			
5.1	Finite Dimensional Spectral Theory	5	E-Resources
5.2	Matrices	3	Chalk & Talk
5.3	Determinants and the spectrum of an operator	5	Discussion
5.4	The spectral theorem	5	Chalk & Talk
<b>Total</b>		<b>90</b>	

## Course Designer

**Ms. A. Benazir**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC43	Optimization Techniques	Core - XIV	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	✓
Global	✓

### Preamble

The course deals with the application of analytical methods such as inventory models, Shortest path problems, queueing models and help to solve decision making problems.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall some basic principles of optimization techniques and solve shortest path problems, Maximal flow problems, CPM and PERT problems.	K1,K2,K3
CO2	Analyze the relationship between exponential and Poisson distribution	K1,K2,K3,K4
CO3	Analyze and solve different models of queueing theory problems	K1,K2,K3,K4
CO4	Summarize game theory and decision Analysis principles and solve some practical problems	K1,K2,K3,K4,K5
CO5	Interpret the principle of non-linear problems.	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	2	2
CO2	3	2	1	2	3
CO3	2	3	2	2	2
CO4	3	2	2	2	3
CO5	3	3	2	3	2

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	3
CO2	3	2	1	3	3
CO3	3	2	2	3	3
CO4	3	3	2	3	3
CO5	2	1	2	3	2

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

18 Hours

Scope of network applications, network definitions, minimal spanning tree algorithm, shortest route Problem, Maximal flow model, minimum cost capacitated flow problem CPM and PERT.

### UNIT II

18 Hours

Why study Queues? Elements of queueing models. Role of exponential distribution, pure birth and death models, relationship between exponential and Poisson distributions, Generalized Poisson queueing model.

### UNIT III

18 Hours

Specialized Poisson queues, (M/M/1) Pollaczek -khintchine (P.K) formula, other queueing models, queueing decision models.

### UNIT IV

18 Hours

Game Theory: Optimal solution of two person zero sum games-solution of mixed.

### UNIT V

18 Hours

Unconstrained problems, constrained problems, Unconstrained non-linear algorithms, constrained algorithms.

## Text Books

Taha, H.A., " *Operation Research- An introduction*", prentice-Hallof India-PvtLtd- VI Edition, 1997.

**UNIT I:** chapter- 6sections: 6.1-6.8

**UNIT II:** chapter 17 sections:17.1 -17.5

**UNIT III:** chapter-17sections17.6-17.10

**UNIT IV:** chapter-14 sections:14. 5.1-14.5.2

**UNIT V:** chapter-20, 21 sections:20.1-20.4

## Reference Books

Kanti Swarap,. Gupta, P.K,Mon Mohan, "**Operation research**" Thoroughly Revised 12<sup>th</sup> Edition

Prof Sundaresan,V., Ganapathy Subramanian K.s., Ganesan, K.,"**Resource Management Techniques "(Operation Research)** A. R. publicatons.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Scope of network applications, network definitions	6	Chalk & Talk
1.2	Minimal spanning tree algorithm, shortest route Problem	6	PPT
1.3	Maximal flow model, minimum cost capacitated flow problem CPM and PERT.	6	E-Resources
<b>UNIT - II</b>			
2.1	Why study Queues? Elements of queueing models.	4	Discussion
2.2	Role of exponential distribution, pure birth and death models	5	Chalk & Talk
2.3	relationship between exponential and Poisson distributions	5	E-Resources
2.4	Generalized Poisson queueing model.	4	Discussion
<b>UNIT - III</b>			
3.1	Specialized Poisson queues, (M/M/1) Pollaczek	6	E-Resources
3.2	khintchine (P.K) formula, other queueing models	6	Chalk & Talk
3.3	Queueing decision models.	6	Discussion
<b>UNIT - IV</b>			
4.1	Game Theory: Optimal solution of two person zero sum games	10	Discussion
4.2	Solution of mixed.	8	E-Resources

<b>UNIT - V</b>			
5.1	Unconstrained problems	5	E-Resources
5.2	Constrained problems	5	Chalk & Talk
5.3	Unconstrained non-linear algorithms	4	Discussion
5.4	Constrained algorithms	4	Chalk & Talk
<b>Total</b>		<b>90</b>	

**Course Designer**

**Mr. M. Vignesh Babu**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAC44	Project- Viva- Voce	Core - XV	105	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The research in Mathematics describes the use of symbols and models as embodiments of mathematical concepts and objects in instructional practice, design and theory, to explorations in semiotics as a central field of interest.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Identify literature review to carry out the project work.	K1,K2,K3
CO2	Analyze characteristic and properties of two and three dimensional geometric shapes and develop mathematical arguments about geometric relationships	K1,K2,K3,K4
CO3	Discover the project work in abstract and applied Mathematics.	K1,K2,K3,K4
CO4	Analyze the existing results and frame new concepts with illustrations	K1,K2,K3,K4
CO5	Assess the project to meet the challenges at society level	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	2	3	2	3	3
CO2	3	2	3	3	3
CO3	2	2	3	2	3
CO4	3	3	2	3	1
CO5	2	1	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	1
CO2	3	2	3	2	3
CO3	2	3	3	2	2
CO4	3	2	2	3	3
CO5	2	3	3	3	1

1-Low

2-Medium

3-Strong

### Marks

External Examiner: Viva: 20

External Examiner: Evaluation of Project: 40

Internal Examiner: Evaluation of Project: 40

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100

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Course Code	Course Title	Category	Total Hours	Credits
20PMAE41	Fluid Dynamics	Elective -IV	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

### Preamble

The course identifies and obtains the values of fluid properties and relates and the principles of continuity, momentum and energy as applied to fluid motions.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Recall the Bernoulli's theorem	K1,K2,K3,K4
CO2	Demonstrate the steady motion	K1,K2,K3,K4
CO3	Develop the Basic singularities	K1,K2,K3,K4
CO4	Analyze the stress tensor and explain Navier stokes equation	K1,K2,K3,K4,K5
CO5	Find Blasius solutions	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
CO1	3	3	1	3	3
CO2	3	3	1	2	3
CO3	2	2	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	2	3	2	2	3
CO4	3	3	2	3	3
CO5	2	3	2	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

15 Hours

Inviscid Theory: Introductory Notions, velocity: Streamlines and paths of the particles- streamtubes and filaments – fluid body- Density – pressure – Bernoulli's theorem, differentiation with respect to time- Equation of continuity – Boundary conditions: kinematical and physical – Rate of change of linear momentum – The equation of motion of an inviscid fluid.

### UNIT II

15 Hours

Euler's momentum theorem – conservative forces – Lagrangian form of the equation of motion – steady motion – the energy equation – rate of change of circulation – vortex motion – Permanence of vorticity.

### UNIT III

15 Hours

Two dimensional motion: Two dimensional functions stream function – velocity potential – complex potential – Indirect approach - Inverse function, Basic Singularities: source – Doublet – vortex – Mixed flow – Method of images: Circle theorem – flow past circular cylinder with circulation. The aerofoil : Blasius's theorem- lift force.

### UNIT IV

15 Hours

Viscous Theory: The equations of motion for viscous flow. The stress tensor – The Navier – stokes equations – vorticity and circulation in a viscous fluid. Flow between parallel flat plates: coquette flow, plane poiseuille flow steady flow in pipes: Hagen Poiseuille flow.

### UNIT V

15 Hours

Boundary Layer Theory : Boundary Layer concept – Boundary layer equations in two dimensional flow – Boundary layer along a flat plate: Blasius solution – Shearing stress and boundary layer thickness – Momentum integral theorem for the boundary layer: The Von karman integral relation by momentum law

## Text Books

L.M. Milne Thomas, Dover, "*Theoretical Hydrodynamics*", 1996.

N.Curle and H.J.Davies "*Modern Fluid Dynamics volume-1* " Dvan Nostrand Company ltd, London 1968.

## Reference Books

S.W Yuan Prentice," *Fountations of fluid Mechanics*", New Delhi, 1988.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Inviscid Theory: Introductory Notions, velocity: Streamlines and paths of the particles	3	Discussion
1.2	Streamtubes and filaments - fluid body-Density - pressure - Bernoulli's theorem,	3	E-Resources
1.3	Differentiation with respect to time-Equation of continuity - Boundary	3	Chalk & Talk
1.4	Conditions: kinematical and physical - Rate of change of linear momentum	3	E-Resources
1.5	The equation of motion of an inviscid fluid.	3	Chalk & Talk
<b>UNIT - II</b>			
2.1	Euler's momentum theorem - conservative forces	4	Chalk & Talk
2.2	Lagrangian form of the equation of motion - steady motion	4	Chalk & Talk
2.3	Tthe energy equation - rate of change of circulation	4	Chalk & Talk
2.4	Vortex motion - Permanence of vorticity.	3	Chalk & Talk

<b>UNIT - III</b>			
3.1	Two dimensional motion: Two dimensional functions stream	3	Chalk & Talk
3.2	function - velocity potential - complex potential - Indirect approach - Inverse function	4	E-Resources
3.3	Basic Singularities: source - Doublet - vortex - Mixed flow - Method of images:	3	Chalk & Talk
3.4	Circle theorem - flow past circular cylinder with circulation.	3	E-Resources
3.5	The aerofoil: Blasius's theorem- lift force.	2	Discussion
<b>UNIT - IV</b>			
4.1	Viscous Theory: The equations of motion for viscous flow. The stress tensor	5	Chalk & Talk
4.2	The Navier - stokes equations - vorticity and circulation in a viscous fluid.	5	E-Resources
4.3	Flow between parallel flat plates: coquette flow, plane poiseuille flow steady flow in pipes: Hagen Poiseuille flow.	5	Discussion
<b>UNIT - V</b>			
5.1	Boundary Layer Theory : Boundary Layer concept - Boundary layer equations in two dimensional flow - Boundary layer along a flat plate: Blasius solution	8	E-Resources
5.2	Shearing stress and boundary layer thickness - Momentum integral theorem for the boundary layer: The Von karman integral relation by momentum law.	7	Chalk & Talk
<b>Total</b>		<b>75</b>	

**Course Designer**

**Ms. D. Gowsalya**

Assistant Professor of Mathematics

Course Code	Course Title	Category	Total Hours	Credits
20PMAE42	Modern Applied Algebra	Elective -IV	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

### Preamble

The course deals with the graph theoretical concepts connectivity, planarity and distance that help to model real life situations.

### Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
C01	Explain about the shortest path problem	K1,K2,K3,K4
C02	Construct the reliable communication networks	K1,K2,K3,K4
C03	Solve the Assignment problems	K1,K2,K3,K4,K5
C04	Explain and Analyze the time tabling problems	K1,K2,K3,K4
C05	Define dominating sets in graphs & Explaining social networks	K1,K2,K3,K4,K5

K1-Knowledge      K2-Understand      K3-Apply      K4- Analyse      K5- Evaluate

### Mapping of CO with PO

	P01	P02	P03	P04	P05
C01	3	3	3	2	2
C02	3	2	2	2	3
C03	2	3	2	2	2
C04	3	2	3	3	3
C05	3	3	3	3	2

1-Low

2-Medium

3-Strong

## Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2
CO2	3	2	3	3	2
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

1-Low

2-Medium

3-Strong

## Syllabus

### UNIT I

15 Hours

Finite State Machines - Introduction, Binary devices and States, Finite - State machines, Covering and equivalence, Equivalence states, A minimization procedure, Turing machines, Incompletely specified machines – Relations between states – a minimization procedure.

### UNIT II

15 Hours

Programming Languages-Introduction, Arithmetic expressions, Identifiers: assignment statements, Arrays, FOR statements, Block structure in ALGOL, The ALGOL grammar, Evaluating arithmetic statements, Compiling arithmetic expressions.

### UNIT III

15 Hours

Boolean Algebras - Introduction, Order, Boolean polynomials, Block diagrams forgetting networks, Connections with logic, Logical capabilities of ALGOL, Boolean applications, Boolean sub algebras, Disjunctive normal form, direct products; morphism.

### UNIT IV

15 Hours

Optimization and Computer Design - Introduction, Optimization, Computerizing Optimization, Logic design, NAND gates and NOR gates, the minimization problem, Procedure for deriving prime implicates, Consensus taking, Flip-flops, Sequential machine.

### UNIT V

15 Hours

Binary Group Codes Introduction, Encoding and decoding, Block codes, Matrix encoding techniques, Group codes, Decoding tables, Hamming codes.

## Text Books

“CBS *Publishers and Distributors* “, NewDelhi, 1987.

**UNIT I:** chapter- 3 sections: 3.1 to 3.9

**UNIT II:** chapter -4 sections: 4.1 to 4.9

**UNIT III:** chapter- 5 sections: 5.1 to 5.10

**UNIT IV:** chapter -6 sections: 6.1 to 6.10

**UNIT V:** chapter- 8 sections: 8.1 to 8.7

## Reference Books

John Hopcroft Jeffery.E., Ullman.,” *Introduction to AutomataTheory*”, Languages, and Computation, Narosa, 19<sup>th</sup> Reprint, 2002.

Bhattacharya P.B, Jain.S. K and., Nagpaul.R.” *Basic Abstract Algebra*”, Published by Cambridge University Press, Second edition.

## Pedagogy

Chalk & Talk, E-Resources, Group Discussion

## Teaching aids

Black Board, LCD Projector

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
<b>UNIT - I</b>			
1.1	Finite State Machines - Introduction, Binary devices and States	4	Discussion
1.2	Finite - State machines, Covering and equivalence, Equivalence states	3	E-Resources
1.3	A minimization procedure, Turing machines, Incompletely specified machines	3	Chalk & Talk
1.4	Relations between states – a minimization procedure.	5	E-Resources
<b>UNIT - II</b>			
2.1	Programming Languages-Introduction, Arithmetic expressions, Identifiers:	5	Chalk & Talk
2.2	Assignment statements, Arrays, FOR statements, Block structure in ALGOL, The ALGOL grammar	5	Chalk & Talk

2.3	Evaluating arithmetic statements, Compiling arithmetic expressions.	5	Chalk & Talk
<b>UNIT - III</b>			
3.1	Boolean Algebras - Introduction, Order, Boolean polynomials	5	Chalk & Talk
3.2	Block diagrams forgetting networks, Connections with logic, Logical capabilities of ALGOL	5	E-Resources
3.3	Boolean applications, Boolean sub algebras, Disjunctive normal form, direct products; morphism.	5	Chalk & Talk
<b>UNIT - IV</b>			
4.1	Optimization and Computer Design - Introduction	3	Chalk & Talk
4.2	Optimization, Computerizing Optimization, Logic design, NAND gates and NOR gates, the minimization problem,	7	E-Resources
4.3	Procedure for deriving prime implicants, Consensus taking, Flip-flops, Sequential machine.	5	Discussion
<b>UNIT - V</b>			
5.1	Binary Group Codes Introduction, Encoding and decoding, Block codes.	7	E-Resources
5.2	Matrix encoding techniques, Group codes, Decoding tables, Hamming codes.	8	Chalk & Talk
<b>Total</b>		<b>75</b>	

**Course Designer**

**Ms. A. Benazir**

Assistant Professor of Mathematics