HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re-Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

DEPARTMENT OF MATHEMATICS

MASTER OF SCIENCE - MATHEMATICS

SYLLABUS

Choice Based Credit System – CBCS

With

Outcome Based Education (OBE)

(Academic Year 2026 - 2027 onwards)

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

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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.

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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 student's 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 itsmission for candidates for a degree in education with mathematics.

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

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

Programme Outcomes (PO)

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

PO1	Acquire Knowledge in recent developments in various branches of mathematics and participate in conferences/seminars/workshops and thus pursue research.
PO2	Develop problem solving skills and apply them independently to problems in pure and applied mathematics
PO3	Sharper their analytic thinking, logical deductions and rigor in reasoning and competent to obtain employment in various sectors.
PO4	Competency to meet global challengers through critical, rational, analytical and logical thinking.
PO5	Apply mathematical methodologies to open-ended real-world situations.

Program Specific Outcomes (PSO)

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

PSO1	Communicate Mathematics effectively using various instructional strategies.
PSO2	Utilize skills to write the proof of Mathematical Statements in a Suitable manner and solve theoretical applied problems
PSO3	Acquire computation, Programming and software skill to get empowered With employability and entrepreneurial skills.
PSO4	Develop confidence to defend the various level of competitive examination and get opportunities for personal and career development.
PSO5	Acquire knowledge of the emerging environmental challenges and providethe 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 – Maths Degree.

For Programme Completion

A Candidate shall complete:

- Part III - Core papers in semesters I, II, III and IV respectively
- Part III - Generic Elective papers in semesters I and II respectively
- Part III - Discipline Elective Papers in semesters III and IV respectively
- Part IV - Skill Enhancement Course (NME) Paper in Semester III respectively
- Part IV - Summer Internship/Industrial Training Paper in semester III respectively
- Part IV - Skill Enhancement Course (Professional Competency Skill) Paper in Semester IV respectively
- Part V - Extension activity in semester IV

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
Assignment	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examinations
(Max. Marks: 75 / Time: 3 Hours)

External Examinations Question Paper Pattern for Part III and Part IV (Non- Major Elective & Skill based Subject)

Section – A (10 X 2 = 20 Marks)

Answer ALL questions.

- Questions 1 - 10
- One question from each unit
- Short answer questions

Section – B (5 X 5 = 25 Marks)

Answer ALL questions (Choose either a or b).

- Questions 11 - 15
- One question from each unit
- Paragraph

Section – C (3 X 10 = 30 Marks)

Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Essay type

Part V (Extension Activities)

- Internal Evaluation only

Passing Marks

Minimum 34 for External Exam
Eligibility for the degree – passing minimum is **50%**

Practical Examination

Internal	– 40 marks
External	– 60 marks (minimum 27 marks)
Total	– 100 marks

Passing minimum is **50%**

Weightage

Weightage for Bloom's Taxonomy	Percentage	Marks	
		CIAE	TEE
Knowledge (Remembering) – K1	8	2	6
Understanding – K2	9	2	7
Applying – K3	12	3	9
Analyzing – K4	12	3	9
Evaluate – K5	40	10	30
Create – K6	19	5(Seminar)	14
Gross Total	**100**	**25**	**75**

Assessment

Distribution of questions and marks for Continuous Internal Assessment Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	1(2)	-	**-**	**Total 25 marks**
Understanding(K2)	1(2)	**-**	**-**	
Apply(K3)	-	1(3)	-	
Analyzing (K4)	-	1(3)		
Evaluate (K5)	-	-	2(10)	
Create (K6)	**Seminar (5)**			

Distribution of questions and marks for Term End Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	3(6)	-	-	**Total 75 Marks**
Understanding(K2)	1(2)	1(5)	-	
Apply(K3)	2(4)	1(5)	-	
Analyzing (K4)	2(4)	1(5)	-	
Evaluate (K5)	-	-	3(30)	
Create (K6)	2(4)	2(10)	-	

Note: Figures in parenthesis are Marks

Credits Distribution

S.No	Part	Category	No of Courses	No of Credits
1	Part - III	Core (Theory / Practical / Project)	15	72
		Discipline Elective (Theory / Practical)	2	6
		Generic Elective (Theory / Practical)	2	6
2	Part - IV	NME	1	2
		Professional Competency	1	2
		Internship	1	2
3	Part - V	Extension Activity	1	1
Total			**23**	**91**

M.Sc., MATHEMATICS

Details of Course Category, Code, Credits & Title

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester – I							
Part – III							
Core – I	26PMACC11	Groups and Rings	6	25	75	100	5
Core – II	26PMACC12	Real Analysis	6	25	75	100	5
Core – III	26PMACC13	Ordinary Differential Equations	6	25	75	100	5
Core – IV	26PMACC14	Graph Theory with Applications	6	25	75	100	4
Generic Elective - I	26PMAGE11	Numerical Methods	6	25	75	100	3
Total			**30**				**22**

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester – II							
Part – III							
Core – V	26PMACC21	Linear Algebra	6	25	75	100	5
Core – VI	26PMACC22	Topology	6	25	75	100	5
Core – VII	26PMACC23	Partial Differential Equations	6	25	75	100	5
Core – VIII	26PMACC24	Probability Theory	6	25	75	100	4
Generic Elective - II	26PMAGE2P	Mathematical Python Lab	6	40	60	100	3
Total			**30**				**22**

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC11	**GROUPS AND RINGS**	**Core - I**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
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.		
UNIT	**Contents**	**No. of Hours**
I	Another counting principle - Sylow's theorem.	18
II	Direct products – Finite Abelian groups.	18
III	Euclidean Rings- A particular Euclidean Ring - Polynomial Rings.	18
IV	Polynomials over the Rational field- Polynomials Rings over Commutative Rings.	18
V	Generators of a subgroup and derived subgroups – Normal series, Solvable groups and Jordan-Holder theorem.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Demonstrate and analyze the concepts of Sylow's theorem.	K1,K2,K3,K4
2	Examine advanced ideas in the algebraic structures in various concepts.	K1,K2,K3,K4
3	Explain the concept of A particular Euclidean Ring	K1,K2,K3,K4,K5
4	Explain the concept of Polynomial Rings .	K1,K2,K3,K4,K5,K6
5	Analyze the Solvable groups and Jordan-Holder theorem.	K1,K2,K3,K4,K5,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks	
1.	Herstein, I.N., **"*Topics in Algebra"*,** Wiley Second Edition 2014, India. **(Unit- I to IV)**
2.	Surjeet Singh Qazi Zameeruddin ., **"Modern Algebra" ,** Vikas Publishing House Pvt. Ltd., Eigth Edition 2015, New Delhi. **(Unit-V)**
Reference Books	
1.	Vijay Khanna .K and Bhambri S.K, "***A course in Abstract Algebra***", Vikas Publishing House Pvt. Ltd., 2015, New Delhi.
2.	Richard M. Foote and David S. Dummit, "***Abstract Algebra"***, John Wiley Publications, 2011, New York.
e-Resources	
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2.	http://www.opensource.org, www.algebra.com

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	2	2	1	3	2
CO3	3	3	3	2	3
CO4	3	2	2	3	2
CO5	3	3	2	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Another counting Principal.	9
1.2	Sylow's Theorem.	9
	UNIT - II	
2.1	Direct Product.	9
2.2	Finite Abelian Groups.	9
	UNIT - III	
3.1	Euclidean Rings.	6
3.2	A Particular Euclidean Ring.	6
3.3	Polynomial Ring.	6
	UNIT - IV	
4.1	Polynomials over the rational field.	9
4.2	Polynomial rings over commutative Rings.	9
	UNIT – V	
5.1	Generators of a subgroup and derived subgroups.	6
5.2	Normal series, Solvable groups.	6
5.3	Jordan-Holder theorem.	6
	Total	**90**

Course Designer
Name: Mr. M. Vignesh Babu
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC12	**REAL ANALYSIS**	**Core - II**	**6**	**5**	**25**	**75**	**100**

Course Objectives

To work comfortably with functions of bounded variation, Riemann-Stieltjes integration, convergence of infinite series, infinite product and uniform Convergence and its interplay between various limiting operations.

UNIT	Contents	No. of Hours
I	**Functions of bounded variation** - Introduction - Properties of monotonic functions -functions of bounded variation - Total variation - Additive property of total variation -Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions – Continuous functions of bounded variation. **Infinite Series :** Absolute and conditional convergence -Dirichlet's test and Abel's test.	18
II	**The Riemann - Stieltjes Integral:** Introduction - Notation – The definition of the Riemann –Stieltjes integral - Linear Properties Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral –Euler's summation formula – Monotonically increasing integrators, Upper and lower integrals -Additive and linearity properties of upper, lower integrals - Riemann's condition.	18
III	**The Riemann-Stieltjes Integral**: Integrators of bounded variation - Sufficient conditions for the existence of Riemann- Stieltjes Integral- Necessary conditions for the existence of RS integrals- Mean value theorems - Integrals as a function of the interval – Second fundamental theorem of integral calculus- Change of variable –Second Mean Value Theorem for Riemann integral -Riemann-Stieltjes integrals depending on a parameter - Differentiation under integral sign.	18
IV	**Infinite Series and infinite Products:** Double sequences - Double series -Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series – Cesaro summability – Infinite products. **Power series:** Multiplication of power series – The Taylor's series generated by a function - Bernstein's theorem.	18
V	**Sequences of Functions:** Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions Uniform convergence and continuity - Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration-Uniform convergence and Differentiation-	18

	Sufficient condition for uniform convergence of a series .	
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Analyze and evaluate functions of bounded variation and Rectifiable Curves.	K1,K2,K3,K4
2	Describe the concept of Riemann-Stieltjes integral and its properties.	K1,K2,K3,K4
3	Demonstrate the concept of step function, upper function, Lebesgue function and their integrals.	K1,K2,K3,K4,K5
4	Construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem.	K1,K2,K3,K4,K5,K6
5	Formulate the concept and properties of inner products, norms and measurable functions.	K1,K2,K3,K4,K5,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks	
1.	Tom M. Apostol.,**" *Mathematical Analysis"***, Second Edition Addison-Wesley Publishing Company Inc., New York, 1974.
Reference Books	
1.	Bartle,R.G. "***Real Analysis"***, John Wiley and Sons Inc.,1976.
2.	Rudin,W. "***Principles of Mathematical Analysis***",3rdEdition.McGrawHill Company, New York, 1976.
3.	Malik,S.C. and Savita Arora. "***Mathematical Analysis***", Wiley Eastern Limited, New Delhi, 1991.
4.	Sanjay Arora and BansiLal**,"*Introduction to Real Analysis*"** ,Satya Prakashan, New Delhi, 1991.
e-Resources	
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2.	http://www.opensource.org, www.mathpages.com

Mapping with Programme Outcomes:

CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
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

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Functions of bounded variation – Introduction.	2
1.2	Properties of monotonic functions.	2
1.3	Functions of bounded variation.	2
1.4	Total variation.	2
1.5	Additive property of total variation.	2
1.6	Total variation on [a, x] as a function of x.	1
1.7	Functions of bounded variation expressed as the difference of two increasing functions.	2
1.8	Continuous functions of bounded variation.	2
1.9	Infinite Series : Absolute and conditional convergence.	1
1.10	Dirichlet's test and Abel's test.	2
	UNIT - II	
2.1	The Riemann - Stieltjes Integral: Introduction – Notation.	2
2.2	The definition of the Riemann–Stieltjes integral.	2
2.3	Linear Properties.	2
2.4	Integration by parts.	2
2.5	Change of variable in a Riemann - Stieltjes integral.	2
2.6	Euler's summation formula.	2
2.7	Monotonically increasing integrators, Upper and lower integrals.	2
2.8	Additive and linearity properties of upper, lower integrals.	2
2.9	Riemann's condition.	2
	UNIT - III	
3.1	The Riemann-Stieltjes Integral : Integrators of bounded Variation.	1
3.2	Sufficient conditions for the existence of Riemann- Stieltjes Integrals.	2
3.3	Necessary conditions for the existence of RS integrals.	2
3.4	Mean value theorems.	2

3.5	Integrals as a function of the interval.	2
3.6	Second fundamental theorem of integral calculus.	2
3.7	Change of variable.	2
3.8	Second Mean Value Theorem for Riemann integral.	2
3.9	Riemann-Stieltjes integrals depending on a parameter.	2
3.10	Differentiation under integral sign.	1
UNIT - IV		
4.1	Infinite Series and infinite Products**.**	2
4.2	Double Sequences and Double Series.	2
4.3	Rearrangement theorem for double series.	2
4.4	A sufficient condition for equality of iterated series.	2
4.5	Multiplication of series.	2
4.6	Cesaro summability.	2
4.7	Infinite products.	1
4.8	**Power series:** Multiplication of power series.	1
4.9	The Taylor's series generated by a function.	2
4.10	Bernstein's theorem.	2
UNIT - V		
5.1	Sequences of Functions: Point wise convergence of sequences of functions.	2
5.2	Examples of sequences of real - valued functions.	2
5.3	Uniform convergence and Continuity.	2
5.4	Cauchy condition for uniform convergence.	2
5.5	Uniform convergence of infinite series of functions.	2
5.6	Riemann - Stieltjes integration.	2
5.7	Non-uniform Convergence and Term-by-term Integration.	2
5.8	Differentiation.	2
5.9	Sufficient condition for uniform convergence of a series.	2
Total		**90**

Course Designer
Name: Dr. A. Benazir
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC13	**ORDINARY DIFFERENTIAL EQUATIONS**	**Core -III**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
To develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points, to study existence and uniqueness of the solutions of first order differential equations.		
UNIT	**Contents**	**No. of Hours**
I	**Linear equations with constant coefficients** Second order homogeneous equations-Initial value problems- Linear dependence and independence-Wronskian and a formula for Wronskian-Non-homogeneous equation of order two.	18
II	**Linear equations with constant coefficients** Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation- Algebra of constant coefficient operators.	18
III	**Linear equation with variable coefficients** Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation –Wronskian and linear dependence – reduction of the order of a homogeneous equation – homogeneous equation with analytic coefficients-The Legendre equation.	18
IV	**Linear equation with regular singular points** Euler equation – Second order equations with regular singular points – Exceptional cases – Bessel Function.	18
V	**Existence and uniqueness of solutions to first order equations**: Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition – convergence of the successive approximations and the existence theorem.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Establish the qualitative behavior of solutions of systems of differential equations	K1,K2,K3,K4, K5
2	Recognize the physical phenomena modeled by differential equations and dynamical systems.	K1,K2,K3,K4, K5
3	Analyze solutions using appropriate methods and give examples.	K1,K2,K3,K4, K5
4	Formulate Bessel Function .	K1, K2, K3,K4,

		K5,K6
5	Understand and use various theoretical ideas and results that underlie the mathematics in this course.	K1,K2,K3,K4, K5,K6
K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating		
Textbooks		
1.	E.A.Coddington, ***A introduction to ordinary differential equations*** (3rd. Printing) Prentice-Hall of India Ltd., New Delhi, 1987.	
Reference Books		
1.	Williams E. Boyce and Richard C. DI Prima, ***Elementary differential equations and boundary value problems***, John Wiley and sons, New York, 1967.	
2.	George F Simmons, ***Differential equations with applications and historical notes,*** Tata McGraw Hill, New Delhi, 1974.	
3	N.N. Lebedev, ***Special functions and their applications***, Prentice Hall of India, New Delhi, 1965.	
4	W.T. Reid. ***Ordinary Differential Equations***, John Wiley and Sons, New York, 1971	
5	M.D.Raisinghania, ***Advanced Differential Equations***, S.Chand& Company Ltd. New Delhi 2001.	
e-Resources		
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,	
2.	http://www.opensource.org, www.mathpages.com	

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	1	3	2	3
CO2	2	1	3	1	3
CO3	3	2	3	1	3
CO4	1	2	3	2	3
CO5	3	1	2	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT - I		

1.1	**Linear equations with constant coefficients:** Second order homogeneous equations**.**	3
1.2	Initial value problems.	4
1.3	Linear dependence and independence.	3
1.4	Wronskian and a formula for Wronskian.	4
1.5	Non-homogeneous equation of order two.	4
UNIT - II		
2.1	**Linear equations with constant coefficients:** Homogeneous equation of order n.	4
2.2	Non-homogeneous equation of order n.	4
2.3	Initial value problems.	4
2.4	Annihilator method to solve non-homogeneous equation.	3
2.5	Algebra of constant coefficient operators.	3
UNIT – III		
3.1	**Linear equation with variable coefficients:** Initial value problems.	2
3.2	Existence and uniqueness theorems.	3
3.3	Solutions to solve a non-homogeneous equation.	2
3.4	Wronskian and linear dependence.	3
3.5	Reduction of the order of a homogeneous equation.	2
3.6	Homogeneous equation with analytic coefficients.	3
3.7	The Legendre equation.	3
UNIT - IV		
4.1	**Linear equation with regular singular points:** Euler equation.	4
4.2	Second order equations with regular singular points.	4
4.3	Exceptional cases.	5
4.4	Bessel Function.	5
UNIT - V		
5.1	**Existence and uniqueness of solutions to first order equations**: Equation with variable separated.	4
5.2	Exact equation.	4
5.3	Method of successive approximations.	4
5.4	The Lipschitz condition.	3
5.5	Convergence of the successive approximations and the existence theorem.	3
Total		**90**

Course Designer
Name: Ms. D. Gowsalya
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC14	**GRAPH THEORY WITH APPLICATIONS**	**Core -IV**	**6**	**4**	**25**	**75**	**100**

Course Objectives		
The course deals with the graph theoretical concepts connectivity, planarity and distance that help to model real life situations.		
UNIT	**Contents**	**No. of Hours**
I	**Introduction:** Graphs and simple Graphs-Graph isomorphism-Incidence and Adjacency Matrices-Subgraphs-Vertex Degrees-Paths and connection-cycles. **Applications:** The Shortest path problem-Sperner's Lemma.	18
II	Trees, Cut Edges and Bonds, Cut Vertices, Cayley's Formula – **Applications:** The Connector Problem – Connectivity,Blocks – **Applications:** Construction of Reliable CommunicationNetworks.	18
III	Euler Tours, Hamiltonian Cycles. **Applications:** TheChinese Postman Problem, The Travelling Salesman Problem.	18
IV	Matching's, Matching's and Coverings in Bipartite Graphs, Perfect Matching. **Applications:** The Personnel Assignment Problem, The Optimal Assignment Problem**.**	18
V	Chromatic Number, Brook's Theorem, Hajos' Conjecture, Chromatic Polynomials, Girth and Chromatic Number. **Applications:** A Storage Problem.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Relate connectivity concepts in the theory of network flow problems	K1,K2,K3,K4
2	Explain matching concepts in job assignment problems	K1,K2,K3,K4,K5
3	Apply the Edge coloring concept in Vizing's Theorem	K1,K2,K3,K4
4	Apply the vertex coloring concepts in A storage problem	K1,K2,K3,K4,K5,K6
5	Analyze and Apply planarity concepts in computer Graphics	K1,K2,K3,K4,K5,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks	
1.	J.A Bondy and U.S.R Murty, ***Graph Theory with Applications***, North Holland, 1976.
Reference Books	
1.	Gary Chartrand and Ping Zhang, ***Introduction to Graph Theory***, Tata McGraw –Hill, New Delhi, 2006.
e-Resources	
1.	https://www.zib.de/groetschel/teaching/WS1314/BondyMurtyGTW A.pdf,

2.	https://www.mygreatlearning.com/blog/application-of-graph theory/https://in.coursera.org/learn/graphs,
3.	https://neo4j.com/blog/top-13-resources-graph-theory-algorithms/

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	2	3
CO2	3	3	3	3	3
CO3	3	3	2	3	2
CO4	2	3	2	3	3
CO5	3	1	3	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Graphs and simple Graphs.	2
1.2	Graph isomorphism.	2
1.3	The incidence and Adjacency Matrices.	2
1.4	Subgraphs.	2
1.5	Vertex Degrees.	2
1.6	Paths and connection.	2
1.7	Cycles.	2
1.8	The Shortest path problem.	2
1.9	Sperner's Lemma.	2
	UNIT - II	
2.1	Trees- Cut Edges and Bonds.	4
2.2	Cut Vertices- Cayley's Formula.	4
2.3	Applications - The Connector Problem .	4
2.4	Connectivity-Blocks.	3

2.5	Applications: Construction of Reliable Communication Networks.	3
UNIT - III		
3.1	Euler Tours.	4
3.2	Hamiltonian Cycles.	4
3.3	Applications: TheChinese Postman Problem.	5
3.4	The Travelling Salesman Problem.	5
UNIT - IV		
4.1	Matchings.	3
4.2	Matching's and Coverings in Bipartite Graphs.	3
4.3	Perfect Matching.	3
4.4	Applications: The Personnel Assignment Problem.	5
4.5	The Optimal Assignment Problem.	4
UNIT - V		
5.1	Chromatic Number.	3
5.2	Brook's Theorem**.**	3
5.3	Hajos' Conjecture.	3
5.4	Chromatic Polynomials**.**	3
5.5	Girth and Chromatic Number**.**	3
5.6	Applications: A Storage Problem.	3
Total		**90**

Course Designer
Name: Dr. M. Vijayasankari
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMAGE11	**NUMERICAL METHODS**	**Generic Elective-I**	**6**	**3**	**25**	**75**	**100**

Course Objectives

The course provides essential computational techniques to solve complex mathematical problems like linear algebraic equations, Interpolation, differentiation, Numerical Integration to solve analytically.

UNIT	Contents	No. of Hours
I	**Transcendental and Polynomial Equations:** Iteration methods based on second degree equation- General iteration methods-system of nonlinear equations- Methods for complex Roots.	18
II	**System of Linear Algebraic Equations and Eigen Value Problems:** Introduction, Direct methods, - Iteration Methods-Eigen values and Eigen vectors, Jacobi method for symmetric matrices.	18
III	**Interpolation and Approximation:** Introduction- Lagrange and Newton interpolations-Finite difference Operators-interpolating polynomials using finite differences-Hermite interpolation.	18
IV	**Differentiation:** Introduction- Numerical Differentiation-Extrapolation methods-Partial Differentiation.	18
V	**Numerical integration**: Methods based on interpolation-Composite integration methods- Romberg Integration.	18
	Total	**90**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Explain the concept of various iteration methods.	K1,K2,K3,K4
2	Demonstrate and Analyze Eigen values and Eigen vectors.	K1,K2,K3,K4
3	Apply finite difference in Interpolating Polynomials.	K1,K2,K3,K4,K5
4	Classify and Explain Differentiation in Numerical Methods.	K1,K2,K3,K4,K5,K6
5	Analyze the Integration in Numerical methods.	K1,K2,K3,K4,K5,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks

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

Reference Books

1. Kandasamy. P., Thilagavathy., K Gunavathi.K., "***Numerical Methods"***, Sultan chand, 2006.
2. Sastry. S.S., "***Introductory Methods of Numerical Analysis"***, Fourth Edition, PHILearning Private Ltd. 2009

3.	Dr. Vedamurthy V.N, Dr. Ch. Iyengar S.N. "***Numerical Methods"***, Vikas Publishing House, 2011.

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
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

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Iteration Methods Based on Second Degree Equation	4
1.2	General Iteration Methods.	5
1.3	System of nonlinear equations.	4
1.4	Methods for complex roots.	5
	UNIT - II	
2.1	Introduction, Direct methods.	4
2.2	Iteration methods.	4
2.3	Eigen values and Eigen vectors.	5
2.4	Jacobi method for symmetric matrices.	5
	UNIT – III	
3.1	Introduction, Lagrange and Newton Interpolations.	3
3.2	Finite difference Operators.	5
3.3	Interpolating polynomials using finite Differences.	5
3.4	Hermite interpolation.	5
	UNIT - IV	
4.1	Introduction.	1

4.2	Numerical Differentiation.	5
4.3	Extrapolation methods.	6
4.4	Partial Differentiation.	6
UNIT - V		
5.1	Numerical integration.	4
5.2	Methods based on interpolation.	5
5.3	Composite integration methods.	4
5.4	Romberg Integration.	5
Total		**90**

Course Designer
Name: Dr. A. Benazir
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC21	**LINEAR ALGEBRA**	**Core - V**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
The course deals with the relation between a linear transformation and matrix. Various properties of transformations are discussed through matrices.		
UNIT	**Contents**	**No. of Hours**
I	Linear independence and bases, Dual spaces, Inner product spaces.	18
II	Modules, The algebra of linear transformations.	18
III	Characteristic roots, matrices, Canonical forms: Triangular form.	18
IV	Nilpotent transformations, A decomposition of V: Jordan form. Canonical forms: Rational canonical form, Trace and Transpose.	18
V	Determinants, Hermitian, Unitary and Normal Transformations, real quadratic forms.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Recall and demonstrate the concept of dual spaces and inner product spaces.	K1,K2,K3,K4
2	Construct the algebra of linear transformations.	K1,K2,K3,K4
3	Analyze and Construct Characteristic roots.	K1,K2,K3,K4,
4	Determine canonical forms and nilpotent Transformations.	K1,K2,K3,K4,K5,K6
5	Demonstrate the Hermitian, Unitary and normal Transformations.	K1,K2,K3,K4,K5,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks	
1.	Herstein., I.N., "***Topics in Algebra"***, John Wiley and sons, 2nd Edition, 1999.
Reference Books	
1.	Joseph Gallian. A., ***Contemporary Abstract Algebra***, Narosa Publication, NewDelhi, 1999.
2.	Vijay K Khanna and Bhambri, S.K***., A course in Abstract Algebra***, Vikas Publishing House Pvt. Ltd., Chennai, 2012.
e-Resources	
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2.	http://www.opensource.org, www.algebra.com

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	1	3
CO2	3	2	1	3	3
CO3	3	3	2	3	1
CO4	1	2	2	1	3
CO5	3	3	2	3	1

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Linear independence and bases.	6
1.2	Dual spaces.	6
1.3	Inner product spaces.	6
	UNIT - II	
2.1	Modules.	9
2.2	The algebra of linear transformations.	9
	UNIT - III	
3.1	Characteristic roots.	5
3.2	Matrices.	8
3.3	Canonical forms -Triangular forms.	5
	UNIT - IV	
4.1	Nilpotent transformation.	5
4.2	A decomposition of V:Jordan form.	5
4.3	Rational canonical form.	4
4.4	Trace and Transpose.	4

UNIT - V		
5.1	Determinants.	6
5.2	Hermitian, Unitary and Normal Transformation real quadratic Forms.	6
5.3	Real quadratic forms.	6
Total		**90**

Course Designer
Name: Dr. A. Benazir
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC22	**TOPOLOGY**	**Core-VI**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.		
UNIT	**Contents**	**No. of Hours**
I	**Topological spaces :** Topological spaces – Basis for a topology – The order topology – The product topology on $X \times Y$ – The subspace topology – Closed sets and limit points.	18
II	**Continuous functions:** Continuous functions – the product topology – The metric topology.	18
III	**Connectedness:** Connected spaces- connected subspaces of the Real line – Components and local connectedness.	18
IV	**Compactness:** Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness.	18
V	**Countability and Separation Axiom**: The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohn metrization Theorem – The Tietz extension theorem.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space	K1,K2,K3,K4
2	Understand continuity, compactness, connectedness, homeomorphism and topological properties.	K1,K2,K3,K4
3	Analyze and apply the topological concepts in Functional Analysis.	K1,K2,K3,K4,
4	Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a topological space.	K1,K2,K3,K4,K5,K6
5	Develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent(homeomorphism).	K1,K2,K3,K4,K5,K6
K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating		
Textbooks		
1.	James R. Munkres, ***Topology (2nd Edition)*** Pearson Education Pt. Ltd., Delhi-2002 (Third Indian Reprint)	

Reference Books	
1.	J. Dugundji, ***Topology***, Prentice Hall of India, New Delhi, 1975.
2.	George F. Sinmons, ***Introduction to Topology and Modern Analysis***, McGraw Hill Book Co., 1963.
e-Resources	
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2.	http://www.opensource.org , http://en.wikipedia.org

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	3	3
CO2	3	1	3	2	3
CO3	2	1	3	2	3
CO4	3	2	3	2	3
CO5	1	2	3	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT - I		
1.1	Topological spaces.	3
1.2	Basis for a topology.	3
1.3	The order topology.	3
1.4	The product topology on $X \times Y$.	3
1.5	The subspace topology.	3
1.6	Closed sets and limit points.	3
UNIT - II		
2.1	Continuous functions.	6
2.2	The product topology.	6
2.3	The metric topology.	6
UNIT - III		

3.1	Connected spaces.	6
3.2	Components and local connectedness.	6
3.3	Connected subspaces of the Real line.	6
UNIT – IV		
4.1	Compact spaces.	4
4.2	compact subspaces of the Real line.	4
4.3	Limit Point Compactness.	5
4.4	Local Compactness.	5
UNIT - V		
5.1	The Countability Axioms.	3
5.2	The separation Axioms.	3
5.3	Normal spaces.	3
5.4	The Urysohn Lemma.	3
5.5	The Urysohn metrization Theorem.	3
5.6	The Tietz extension theorem.	3
Total		**90**

Course Designer
Name: Dr. M. Vijayasankari
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC23	**PARTIAL DIFFERENTIAL EQUATIONS**	**Core - VII**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
To classify the second order partial differential equations and to study Cauchy problem, method of separation of variables, Linear equations of the first Order .		
UNIT	**Contents**	**No. of Hours**
I	**Mathematical Models and Classification of second order equation:** Classical equations-Vibrating string – Vibrating membrane –waves in elastic medium – Conduction of heat in solids – Gravitational potential .	18
II	**Cauchy Problem :** The Cauchy problem – Cauchy-Kowalewsky theorem – Homogeneous wave equation – Initial Boundary value problem- Non-homogeneous boundary conditions – Finite string with fixed ends – Non-homogeneous wave equation – Riemann method – Goursat problem.	18
III	**Method of separation of variables:** Separation of variable- Vibrating string problem – Existence and uniqueness of solution of vibrating string problem- Heat conduction problem – Existence and uniqueness of solution of heat conduction problem – Laplace and beam equations.	18
IV	**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.	18
V	**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.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Apply concept of Classical equations	K1,K2,K3,K4
2	Explain the Cauchy problem and Homogeneous wave equation	K1,K2,K3,K4,K5
3	Analyze the Separation of variables and Heat conduction problem	K1,K2,K3,K4
4	Find the Origins of first order Partial Differential Equations-Cauchy's problem for first order equations	K1,K2,K3,K4,K5,K6
5	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,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks	
1.	TynMyint.U and Lokenath Debnath, ***Partial Differential Equations for Scientists and Engineers*** (Third Edition), North Hollan, New York, 1987.
2.	Ian Sneddon., " ***Elements of Partial differential equations***" Tata McGraw Hill Book Company, 1986.
Reference Books	
1.	Simmons. G. F and Krantze, " ***Differential Equations"***, 3rd Edition, Tata McGrawHill Publishing company, 2006.
2.	Amarnath.T "***An elementary course in PDE"*** Narosa Publication, 1997
3.	Rukmangadachari. E "***Differential equation"*** Dorling Kindersley India Pvt.Ltd, 2012
e-Resources	
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
2.	http://www.opensource.org, www.mathpages.com

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	1	3	2	3
CO2	2	1	3	1	3
CO3	3	2	3	1	3
CO4	1	2	3	2	3
CO5	3	1	2	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT - I		
1.1	**Mathematical Models and Classification of second order equation:** Classical equations.	2
1.2	Vibrating string.	3

1.3	Vibrating membrane.	3
1.4	waves in elastic medium.	4
1.5	Conduction of heat in solids.	3
1.6	Gravitational potential.	3
UNIT - II		
2.1	**Cauchy Problem:** The Cauchy problem.	3
2.2	Cauchy-Kowalewsky theorem – Homogeneous wave equation.	3
2.3	Initial Boundary value problem.	2
2.4	Non-homogeneous boundary conditions.	2
2.5	Finite string with fixed ends.	2
2.6	Non-homogeneous wave equation.	2
2.7	Riemann method.	2
2.8	Goursat problem.	2
UNIT - III		
3.1	**Method of separation of variables:** Separation of variable.	2
3.2	Vibrating string problem.	2
3.3	Existence and uniqueness of solution of vibrating string problem.	3
3.4	Heat conduction problem.	4
3.5	Existence and uniqueness of solution of heat conduction problem.	4
3.6	Laplace and beam equations.	3
UNIT - IV		
4.1	Partial differential equations.	2
4.2	Origins of first order Partial differential Equations.	2
4.3	Cauchy's problem for first order equations.	2
4.4	Linear Equations of the first order.	4
4.5	Integral surfaces passing through a given Curve.	4
4.6	Surfaces orthogonal to a given system of surfaces.	4
UNIT – V		
5.1	Nonlinear Partial differential equations of the first order.	3
5.2	Cauchy's method of characteristics.	3
5.3	Compatible Systems of first order Equations.	4
5.4	Charpit's method.	4
5.5	Special types of first order equations.	4
Total		**90**

Course Designer
Name: Ms. D. Gowsalya
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMACC24	**PROBABILITY THEORY**	**Core-VIII**	**6**	**4**	**25**	**75**	**100**

Course Objectives

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

UNIT	Contents	No. of Hours
I	**Random Events and Random Variables:** Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.	18
II	**Parameters of the Distribution:** Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.	18
III	**Characteristic functions:** Properties of characteristic functions – Characteristic functions and moments – semi0invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.	18
IV	**Some Probability distributions:** One point, two point, Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.	18
V	**Limit Theorems:** Stochastic convergence – Bernoulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – de Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.	18
	Total	**90**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	To define Random Events, Random Variables, to describe Probability, to apply Bayes, to define Distribution Function, to find Joint Distribution function, to find Marginal Distribution and Conditional Distribution function, to solve functions on random variables.	K1,K2,K3,K4

2	To define Expectation, Moments and Chebyshev Inequality, to solve Regression of the first and second types.	K1,K2,K3,K4,K5
3	To define Characteristic functions, to define distribution function, to find probability generating functions, to solve problems applying characteristic functions.	K1,K2,K3,K4
4	To define One point, two-point, Binomial distributions, to solve problems of Hypergeometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions, to solve problems on Cauchy and Laplace distributions.	K1,K2,K3,K4,K5,K6
5	To discuss Stochastic convergence, Bernaulli law of large numbers, to elaborate Convergence of sequence of distribution functions, to prove Levy-Cramer Theorems and de Moivre-Laplace Theorems, to explain Poisson, Chebyshev, Khintchine Weak law of large numbers, to explain and solve problems on Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.	K1,K2,K3,K4,K5,K6
K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating		
Textbooks		
1.	M. Fisz, ***Probability Theory and Mathematical Statistics,*** John Wiley and Sons, New York, 1963.	
Reference Books		
1.	R.B. Ash, ***Real Analysis and Probability***, Academic Press, New York, 1972	
2.	K.L. Chung, ***A course in Probability***, Academic Press, New York, 1974.	
3.	R. Durrett, ***Probability: Theory and Examples***, (2nd Edition) Duxbury Press, New York, 1996.	
4.	V.K. Rohatgi ***An Introduction to Probability Theory and Mathematical Statistics***, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).	
e-Resources		
1.	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,	
2.	http://www.opensource.org, http://www.probability.net	

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	1	3	2	3
CO2	2	1	3	1	3
CO3	3	2	3	1	3
CO4	1	2	3	2	3
CO5	3	1	2	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Random events – Probability axioms.	3
1.2	Combinatorial formulae – conditional probability – Bayes Theorem.	3
1.3	Independent events – Random Variables – Distribution Function.	3
1.4	Joint Distribution – Marginal Distribution – Conditional Distribution.	4
1.5	Independent random variables – Functions of random variables.	5
	UNIT - II	
2.1	Expectation- Moments.	6
2.2	The Chebyshev Inequality – Absolute moments – Order parameters.	6
2.3	Moments of random vectors – Regression of the first and second types.	6
	UNIT - III	
3.1	Properties of characteristic functions – Characteristic functions and moments.	4
3.2	semi invariants – characteristic function of the sum of the independent random variables.	5
3.3	Determination of distribution function by the Characteristic function.	4
3.4	Characteristic function of multidimensional random vectors – Probability generating functions.	5
	UNIT - IV	
4.1	One point, two point, Binomial distributions.	4
4.2	Polya – Hypergeometric – Poisson (discrete) distributions.	4
4.3	Uniform – normal gamma – Beta distributions.	5
4.4	Cauchy and Laplace (continuous) distributions.	5
	UNIT – V	

5.1	Stochastic convergence – Bernoulli law of large numbers.	3
5.2	Convergence of sequence of distribution functions – Levy-Cramer Theorems.	3
5.3	De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers.	4
5.4	Lindberg Theorem – Lapunov Theroem.	4
5.5	Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.	4
Total		**90**

Course Designer
Name: Mr. M. Vignesh Babu
Assistant Professor of Mathematics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PMAGE2P	**MATHEMATICAL PYTHON LAB**	**Generic Elective -II**	**6**	**3**	**40**	**60**	**100**

Course Objectives		
The course make use of python programming language to construct basic program for solving mathematical problems.		
UNIT	**Contents**	**No. of Hours**
I	• Write a Python Program to check the Largest among the given three numbers. • Write a Python Program to find the HCF of some given numbers. • Write a Python Program to compute the Factorial of a given numbers using Recursion • Write a Python Program to check if the input year is a leap year or not.	18
II	• Write a Python Program to display Fibonacci sequence using Recursion. • Write a Python Program to Solve f(x)=0 Using Bisection Method • Write a Python Program to Solve $y' = f(x, y)$ with given initial conditions using RK method. • Write a Python Program to print the prime numbers for a user provided range.	18
III	• Write a Python Program that demonstrates the Built- in Functions. • Write a Python Program to demonstrates Various String Functions and Operations. • Write a Python Program to demonstrates List Functions and Operations • Write a function to convert a decimal number to its binary, octal and hexadecimal equivalence.	18
IV	• Write a Python Program to demonstrate Tuple Functions and Operations. • Write a Python program to demonstrate the Dictionaries Functions and Operations. • Write a Python program to demonstrate the File and file I/O operations. • Write a Python Program to add to matrices	18
V	• Write a Python program to demonstrate Classes and their Attributes. • Write a Python program to demonstrate Inheritance and Method Overriding.	18

	• Write a Python Program to demonstrate multiple Inheritance • Line plot, Bar chart, Histogram, Scatter plot, Pie chart, Contour plot, Subplots.	
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Make use of the python programming language to construct basic program for solving mathematical problems.	K1,K2,K3,K4,K5
2	Develop Python programs by defining functions and calling them.	K1,K2,K3,K4
3	Use Python data structures – lists, tuples & amp; dictionaries for representing compound data	K1,K2,K3,K4
4	Develop Python programs using files.	K1,K2,K3,K4,K5,K6
5	Visualize various types of chats, including line plot bar chart, histogram and more.	K1,K2,K3,K4,K5,K6

K1-Knowledge K2-Understand K3-Apply K4- Analyse K5- Evaluate K6- Creating

Textbooks	
1.	E.Balagurusamy, ***Introduction to Computing and Problem Solving Using Python***,McGraw Hill Education (India)Private Limited,2021.
Reference Books	
1.	Jahn Kiusalaas ***Numerical Methods in Engineering with Python3***,Cambridge University Press,2013
2.	Dr.Ossama Embarak,***Data Analysis and Visualization Using Python***, Apress,UAE 2018
e-Resources	
1.	The Joy of Computing using Python-Course(nptel.ac.in) Python for Data Science –Course (nptel.ac.in)

Mapping with Programme Outcomes:

CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	1	3	2	3
CO2	2	1	3	1	3
CO3	3	2	3	1	3
CO4	1	2	3	2	3
CO5	3	1	2	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LAB SCHEDULE

Module No.	Topic	No. of Hours
	UNIT - I	
1.1	Write a Python Program to check the Largest among the given three numbers	4
1.2	Write a Python Program to Find the HCF of some given numbers	4
1.3	Write a Python Program to compute the Factorial of a given numbers using Recursion	5
1.4	Write a Python Program to check if the input year is a leap year or not	5
	UNIT - II	
2.1	Write a Python Program to display Fibonacci sequence using Recursion	4
2.2	Write a Python Program to Solve f(x)=0 Using Bisection method	4
2.3	Write a Python Program to Solve $y' = f(x, y)$ with given initial conditions using RK method	5
2.4	Write a Python Program to print the prime numbers for a user provided range	5
	UNIT - III	
3.1	Write a Python Program that demonstrates the Built- in Functions	4
3.2	Write a Python Program to demonstrates Various String Functions and Operations	4
3.3	Write a Python Program to demonstrates List Functions and Operations	5
3.4	Write a function to convert a decimal number to its binary, octal and hexadecimal equivalence	5
	UNIT - IV	
4.1	Write a Python Program to demonstrate Tuple Functions and Operations	4
4.2	Write a Python program to demonstrate the Dictionaries Functions and Operations	4
4.3	Write a Python program to demonstrate the File and file I/O Operations	5
4.4	Write a Python Program to add to matrices	5
	UNIT - V	
5.1	Write a Python program to demonstrate Classes and their Attributes	4
5.2	Write a Python program to demonstrate Inheritance and Method Overriding	4
5.3	Write a Python Program to demonstrate multiple Inheritance	5

5.4	Line plot, Bar chart, Histogram, Scatter plot, Pie chart Contour plot, Subplots	5
	Total	**90**

Course Designer
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